REQUIREMENTS OF AN IDEAL VACUUM

DEC 16 1912

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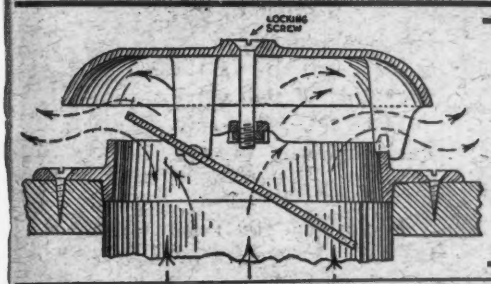

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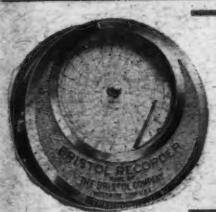

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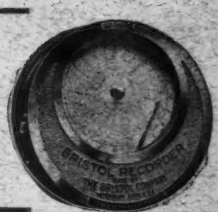

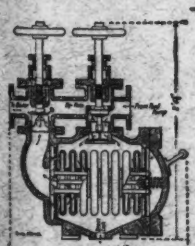

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK DECEMBER, 1912

Vacuum Cleaning

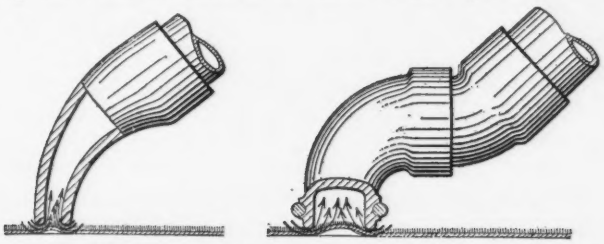
BY MAXWELL S. COOLEY,

Supervising Architect's Office, Washington, D. C.

I.—REQUIREMENTS OF AN IDEAL VACUUM CLEANING SYSTEM.

Before a comparison of the relative merits of any line of appliances, used for any one purpose, can be intelligently made one must have either some form of that apparatus which we consider as a standard for comparison that we may rate all others as inferior or superior thereto, or else an ideal of a perfect system must be assumed, and the measures with which each of the various appliances approach the requirements of the ideal will establish their relative merits.

The author has elected to use the latter methods in determining the relative merits of the various systems of vacuum



THE RENOVATOR ON THE LEFT DOES NOT FULFILL THE SECOND REQUIREMENT OF AN IDEAL SYSTEM IN THAT IT WILL NOT TAKE UP ORDINARY LITTER. THE RENOVATOR ON THE RIGHT FULFILLS THIS REQUIREMENT.

cleaning and it is necessary, therefore, to first determine what are the requirements we shall impose on the ideal system.

When the vacuum cleaner is installed, it should at once displace all appliances used for dry cleaning in the semi-annual renovating or house cleaning, the weekly cleaning or Friday sweeping day, and the daily supplemental cleaning.

The compressed air cleaners first introduced were intended for use only at the semi-annual cleaning and they were in

reality carpet renovators, which were assumed as imparting to the carpets all the beneficial results that could be obtained by taking them up and sending them to a carpet-cleaning establishment, with the advantage over this latter method, that the labor of removal and replacement of the carpets was rendered unnecessary, but with the disadvantage that all the germ-laden air, used as a means of cleaning the carpets, was blown back into the apartment, leaving the germs in their former abode.

This disadvantage, however, is partly offset by the fact that while the majority of the germs in one's own carpet are blown out at the carpet cleaners, a mixed company of germs from your neighbors' and others carpets, which may be in the tumbling barrel at the same time with your own, are returned to you with your carpet.

Neither of these conditions is ideal and we will expect our ideal cleaner to completely remove from the premises, not only the dust and dirt, but also the germ-laden air which is used as a means of conveying this dirt.

For replacing the weekly and the daily cleaning, these earlier renovators were not suitable, as in order to use same the furniture must all be removed from the apartment.

To accomplish this daily and weekly cleaning, the ideal vacuum cleaner must replace the broom and dust pan, and their inseparable companion, the duster, and must also supersede that time-honored mechanical cleaner, the carpet sweeper.

To accomplish this our ideal cleaner must be capable of picking up small scraps of paper, match sticks, cigar stumps, pins, needles, bits of thread, loose tacks, and all other small articles in order to render necessary only the removal of large pieces of paper and other articles readily picked up by hand as a preliminary action to the use of the vacuum cleaner.

The ability to accomplish this requirement is lamentably lacking in very many vacuum cleaning systems.

The ideal cleaner must be able to accomplish the above stated requirements without the necessity of moving heavy pieces of furniture out of or about the apartment; that is, it must be capable of being efficiently operated under beds, tables and chairs, around the legs of other heavy furniture, behind bookcases, pianos, cabinets, etc., over curtains, draperies and hangings, over walls, behind pictures and over mouldings and carved ornaments, all without injury to any of the furniture or fittings of the apartment, and with the least expenditure of energy by the operator.

These conditions should be met with the fewest possible number of cleaning appliances, none of which should be provided with small attachments liable to be lost or misplaced and all parts of the system, which must necessarily be moved about, either before, after or during the cleaning operation, should be of minimum weight and bulk, but of rugged and lasting construction.

The ideal vacuum cleaner should be of such proportions and provided with ample motive power to clean rapidly and effectively.

For use in an office building the cleaner should be able to thoroughly clean an average-sized office, including floor, walls, furniture and fittings in from 10 to 15 minutes, and for residence work, should be of sufficient capacity to clean an apartment including, floor, walls, curtains, draperies, pictures and furniture in not exceeding 30 minutes.

The ideal system should be so arranged that any apartment in the building can be cleaned with the least possible disturbance and without affecting the use of any other apartment, excepting perhaps, the corridors or hallways, while working in any apartment in the building.

In large offices, drafting rooms and similar apartments, it may become necessary to clean same while they are occupied; therefore, our ideal system must be practically noiseless in operation and must offer the least possible obstruction to the proper use of the room by its regular occupants.

LOCATION OF STATIONARY PARTS.

The stationary parts of the cleaning system must nearly always be located within the building cleaned and, therefore, must operate with the minimum amount of noise and vibration. Especially in residences they must require the minimum attention and must be capable of being started and stopped by any person of average ability, without the necessity of going to the point at which the machine is located.

The power consumption of the ideal system shall be a minimum to accomplish satisfactory results and should be, as nearly as possible, directly proportioned to the amount of cleaning being done. This requirement is most important in hotels, where some cleaning is likely to be done at all hours, day and night. In other words, vacuum must be "on tap" and as readily attainable at any point in the building as your water or electric light. In office buildings, where a schedule of cleaning hours is fixed, and in residences where cleaning hours are few and the capacity of the plant is rarely more than the requirements of one operator, this requirement is not of as great importance.

Lastly, our ideal system, from the standpoint of the purchaser, must be of such rugged construction, as will enable it to operate efficiently for, at least, ten years and its mechanical details such that it will operate continuously, without expert attention, and that the annual expense for repairs during the life of the machine will not exceed 5% of the first cost of the system.

In the January number Mr. Cooley will discuss the construction and operation of various types of renovators in vacuum cleaning works.

Advanced Methods in Heating and Ventilating an Office Building

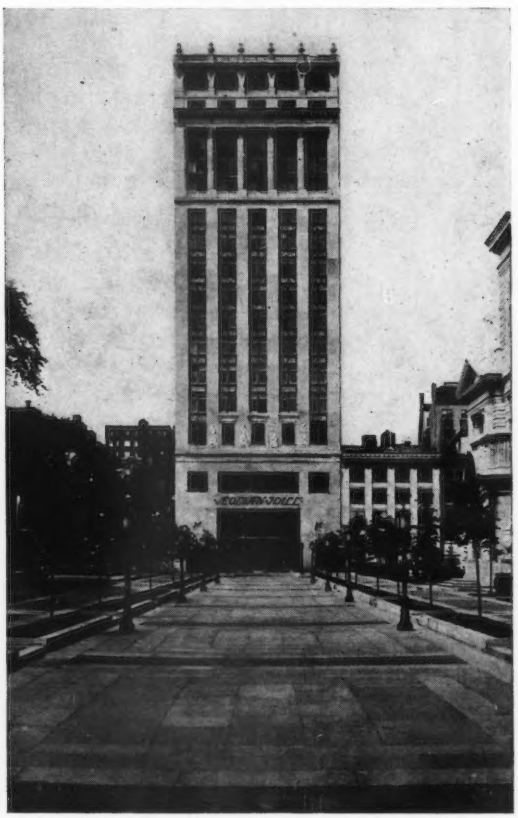
EQUIPMENT OF AEOLIAN HALL, NEW YORK.

One of the finest additions to New York's office buildings is "Aeolian Hall," located near Fifth Ave., on 42nd St. This structure is of fireproof construction throughout and ranks as a particularly high-class building of its type. The first and second floors are mainly utilized as a hall and balcony for concerts given by both the Aeolian Company and outside associations; the next upper floors are reserved for demonstrations of pianos, player pianos, phonographs and other musical instruments. Above this, the floors are intended for office use and present more or less of a difficult heating proposition on account of the unusually high ceilings, which are claimed to be the highest of any building used for office purposes in the city.

The heating of the Aeolian Hall building is by means of a combination of both direct and indirect systems. The steam supply for heating is furnished, as far as possible, by the exhaust steam from the pumps, engines and other apparatus located in the sub-basement. The Cooper engines are used to operate two 200-K. W. generators and one 100-K. W. generator. Provision is made for helping out this supply by means of direct high pressure steam, introduced into the heating system through a reducing valve. In either case the circulation of steam is maintained at atmospheric pressure or less by means of the vacuum system installed. This results in no back pressure being exerted on the pump and engine exhausts which are carried through on 800 H. P. Utility muffler tank and feed water heater.

Three Babcock & Wilcox water-tube sectional boilers of the longitudinal drum type with a heating surface of 6,090 sq. ft. are located in the sub-basement, as shown in Fig. 1. These boilers are built for a working pressure of 160 lbs. per square inch and have a grate surface of 192 sq. ft. with Dean dumping type grates and Webster furnaces. They have 5-in. nickel seated safety valves steam gauges, blow-off valves and the other usual accessories, the steam nozzles being 8 in. in size and the blow-offs 2½ in.

Connection to the smoke stack is made by means of rectangular wrought-iron breeching of No. 12 gauge black wrought iron, with heavy angle iron corners, riveted joints, into which the 40 in. x 60 in. boiler flues are connected. Support is furnished by wrought-iron



AEOLIAN HALL, WEST 42D STREET, NEW YORK.

connections from the boiler room ceiling.

Each boiler has hand dampers provided in its flue connection with chains and links ready for damper regulator connections. In the smoke connection is provided a single balanced damper operated by a damper regulator.

The blow-off tank is about 3 ft. x 6 ft., with 5-16-in. shell and ⅜-in. heads. This tank is connected to the

blow-off cocks on the boilers by means of wrought-iron pipe and cast iron fittings, and has a vapor line run over to a vertical shaft and up the shaft to the open air. The discharge is connected into the pump.

Near the boilers is provided a 1½-in. thick marble gauge board. The guage board has six gauges, one for Boiler No. 1, one for Boiler No. 2, one for Boiler No. 3, one for compound pressure and vacuum, one for recording, and one eight-day clock, Howard movement.

Direct Heating.

The expansion and contraction on the heating risers is taken care of by pumps, Scranton Mine pattern. The boiler feed pumps are 7½ in. x 4½ in. x 10 in.

The blow-off and sump pumps consist of two 6 in. x 4 in. x 6 in. Class 3, Worthington piston pumps. There are also air compressors for vacuum and temperature regulating apparatus.

Indirect Heating and Ventilating Apparatus

Fresh air is furnished to the boiler and engine room in the sub-basement, to the rooms in the basement, to the auditorium and gallery, to the small rooms on the third floor and to the third floor mezzanine and on the fourth floor as later described, while exhaust ventilation is arranged for these and also

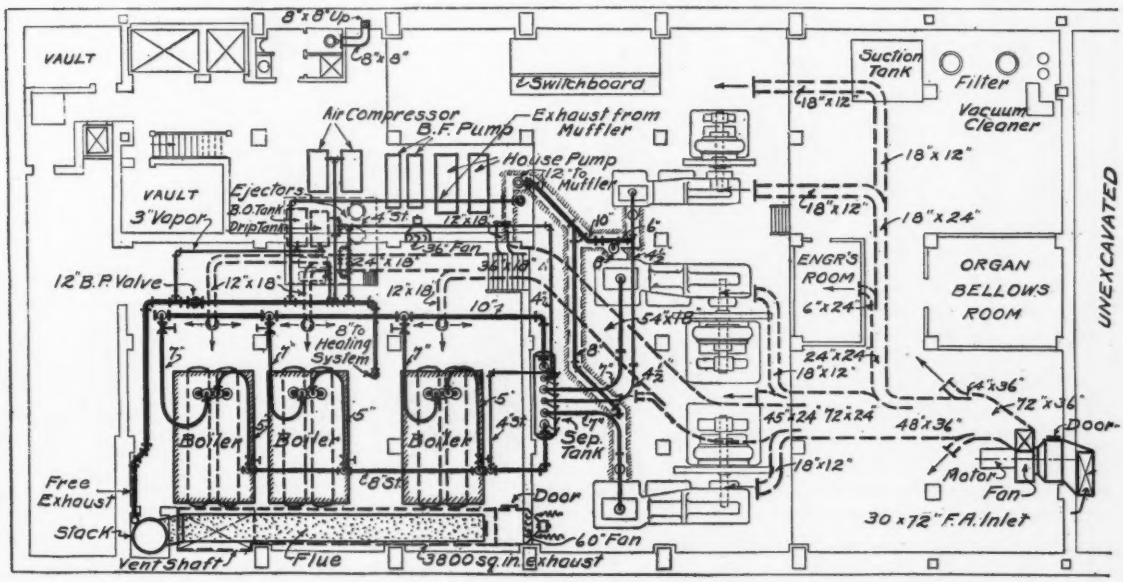


FIG 1—SUB-BASEMENT, AEOLIAN HALL, SHOWING APPARATUS FOR MECHANICAL EQUIPMENT.

extra heavy bronze sleeve expansion joints which are anchored to the building steel, having flat bosses tapped for the anchorage straps.

As shown on the sub-basement plan (Fig. 1), on top of the boiler nozzles is placed a valve, and pipe bends connect these points to the main steam header which runs to the separator, from which the various valved steam branches are taken. This steam separator tank has a lagging of Russia iron and brass heads. A detail of the receiver and separator is shown in Fig. 2.

The house and fire pumps consist of two 14 in. x 7 in. x 10 in. Worthington

the interior toilet rooms throughout the building.

The fans used to move the air in both the heating and exhaust systems are mounted on foundations covered with cork sheets to prevent the transmission of noise and vibration, and are driven by

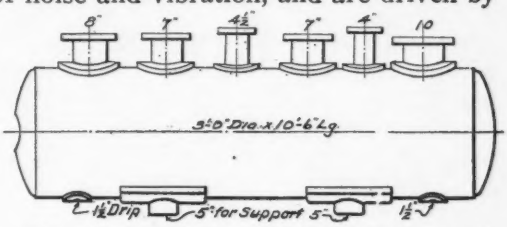


FIG. 2—DETAIL OF RECEIVER AND SEPARATOR.

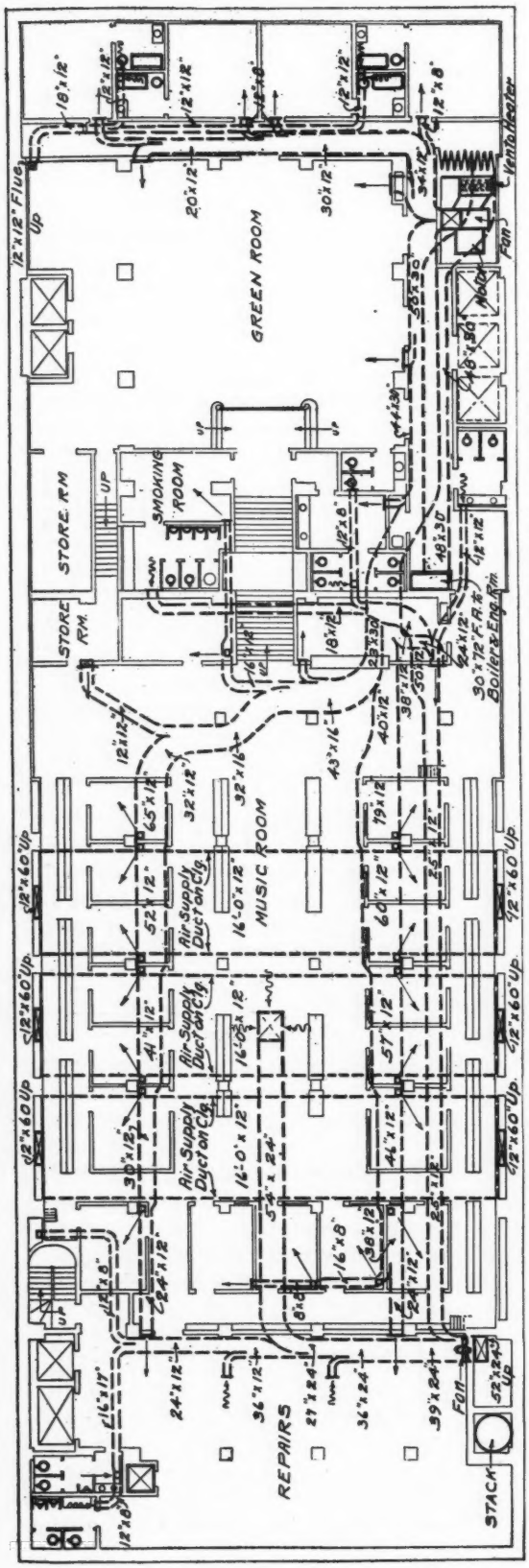


FIG. 3—BASEMENT FLOOR, SHOWING DUCTS ON CEILING SUPPLYING AUDITORIUM.

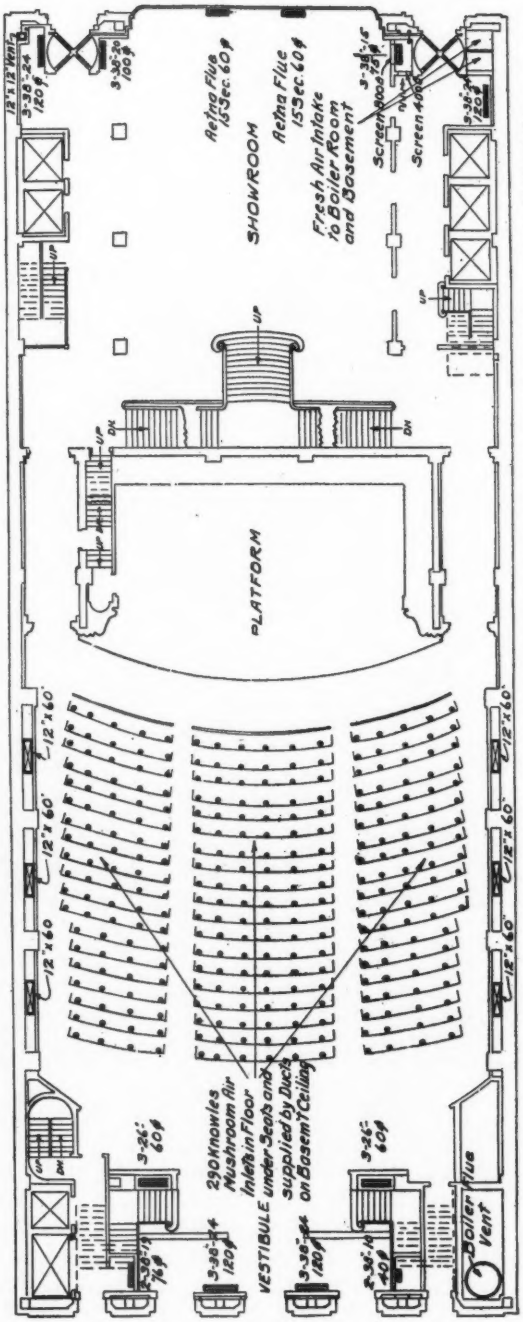


FIG. 4—AUDITORIUM FLOOR, AEOLIAN HALL, EQUIPPED WITH INDIVIDUAL AIR INLETS.

electric motors through flexible couplings, and are as follows:

One No. 8 multivane Sturtevant fan 35 in. diameter wheel by 2 ft. wide casing with 24 in. x 36 in. discharge, driven by 7 H. P. Diehl motor, located in the fifth floor.

Three No. 10 multivane Sturtevant fans, 46½ in. wheel by 32 in. wide casing, bottom side outlet 40 in. x 32¾ in., driven by a Diehl motor of 11½ H. P., running 200 to 280 R. P. M., and having three 60-in. and three 50-in. Vento sections, 12 loops, 5⅜ in. on centers, located one in the engine room and two on the third floor mezzanine.

One Sturtevant fan, same as above, with top outlet driven by similar motor of 14 H. P., running 220 to 300 R. P. M., and having three 60-in. Vento sections, 11 loops, located in front basement.

Also one No. 8 multivane fan with a 5 H. P. Diehl motor on fourth floor.

One 42-in. exhaust fan, American Blower Co.'s "Ventura" type, duplex cone, for toilet rooms.

All fan motors are of the multipolar type and have speed regulating devices.

The heaters contain sufficient surface to deliver the air at 70° F. and are jacketed with No. 12 gauge steel plate. provided with tight-fitting access doors. Fig. 5 shows the method used in installing these fans, motors and coils.

The disc fans which are used are the American Blower Company's "Ventura" type and are operated by direct-connected motors.

The air filters which are erected in the fresh air chambers consist of wooden frames of various sizes necessary to suit the conditions (and protected against moisture by waterproof paint), over which is stretched cheese cloth. The frames are supported on galvanized iron framework stiffened with tee irons. all iron work used on the filters being of double galvanized iron. An extra set of these frames is provided for each filter.

All the registers have iron faces, finished in electro, copper, brass, bronze, nickel plate, white enamel or painted as the decoration of the rooms require. On the auditorium floor (Fig. 4) Knowles mushroom air inlets are used, supplied by ducts shown on the ceiling of the basement (Fig. 3). Thermostatic regulation controlling the tempering coils of the ventilating apparatus is also provided.

Above the first floor is the gallery or second floor, which has top exhaust registers all around the sides and also in the ceiling. The third floor is the floor where the piano tryout rooms are located. These rooms are provided with fresh air inlets connected on to ducts which have electric disc fans taking their

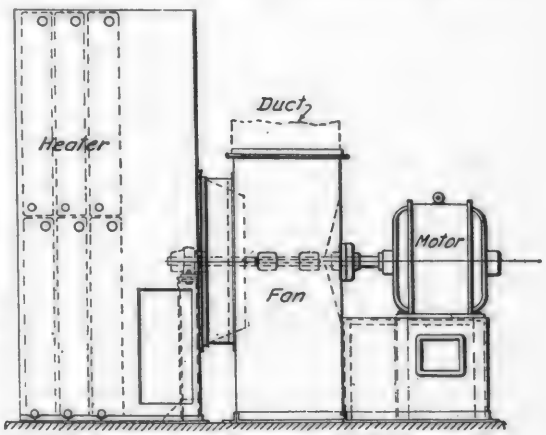


FIG. 5—TYPICAL ARRANGEMENT OF HEATER, FAN AND MOTOR.

supply from a large show room in the center. These fans are arranged with electric control by push button, so that on taking a customer into any one of the tryout rooms a push of the button starts the fan and the ventilation system, while at departure another push of the button shuts the fan off.

ARRANGEMENTS FOR REVERSING VENTILATING SYSTEM IN AUDITORIUM.

On the fourth floor, where are located the two No. 10 multivane fans, one takes its supply through an air filter and Vento heater, while the other discharges into a vent shaft. These two fans are connected to the exhaust and air supply ducts which run down to the auditorium and gallery and are cross-connected, with a by-pass, in such a way that air supply can be put in the top of the auditorium by connecting the air supply fan onto the vent flues, in which case the other fan draws the vitiated air off of the floor through the mushroom inlets and discharges it into the vent shaft.

In case it is desired to reverse this operation, a turn of the damper in the by-pass throws the air from the supply fan into what are normally the fresh air ducts which supply the mushroom inlets and at the same time connects the exhaust fan to the regular ceiling exhaust outlets, thus making it possible to put fresh air in at the bottom and draw the stale air off at the top.

The rooms on the fourth floor, which are also used for piano demonstration, are ventilated and heated in a manner similar to that described for the corresponding rooms on the third floor. The fourth floor is provided with a fan drawing air through an air filter and Vento heater sections, and supplying it through a system of ducts to the various divisions on this floor, while a ceiling vent system is installed which is carried over to the vent shaft and operates with a disc fan.

The architects of the building are Warren & Wetmore, New York. The heating plant was designed and installed by Baker, Smith & Co., New York, and is now in operation.

Graphical Solution of Heating Problems

By H. J. Thorkelson,

ASSOCIATE PROFESSOR OF STEAM ENGINEERING, UNIVERSITY OF WISCONSIN.

Two interesting contributions to the collection of graphical charts for the solution of heating problems, both developed by students of the University of Wisconsin, are described and presented by Prof. H. J. Thorkelson in the university publication, The Wisconsin Engineer, together with the formula used for calculating the heat losses in connection with the newly-built university buildings.

The general plan followed was to provide direct radiation in the rooms to supply the heat necessary for radiation and convection losses, and where ventilating systems are installed, to install such additional indirect heating surface as will be required to heat the fresh air used for ventilation, to room temperature.

THE FORMULA USED.

The direct radiation surface required for rooms is computed by deriving a formula based on the following heat losses per degree difference of temperature per hour per unit used: Radiation, glass, 1 B. T. U. per square foot; wall, 0.25 B. T. U. per square foot. Convection, 0.04 B. T. U. per cubic foot of space.

As outdoor temperatures of — 20° F. are frequent (in Wisconsin), it was necessary to base calculations on a 90° difference of temperature, giving an hourly heat loss of

$$\frac{90}{300}\ (G + 0.25W + 0.04C) \text{ or}$$

$$0.3\ (G + 0.25G + 0.04\ C)$$

and this is the formula used to determine the square feet of radiating surface required.

CHART FOR DETERMINING AREAS AND CUBICAL CONTENTS.

In order to expedite calculations of this kind, one of our former students, E. F. Johns, constructed a diagram for determining areas and cubic contents graphically (shown in Fig. 1). Areas are found by using the inclined lines from the lower left hand corner and Scale A for the two dimensions, with the product shown on Scale B.

If volumes are desired, the area is first found as above on Scale B and this result is transferred to Scale C and followed in a vertical line to the dimensions of height shown on the lines radiating from the lower right hand corner. The volume will be shown by Scale D. This enables easy calculations of G, W and C.

CIRCULAR SLIDE RULE FOR CALCULATING REQUIRED RADIATION.

In order to permit simple calculations of the required radiating surface from the above formula, E. F. Week, U. W. '12, constructed the ingenious circular slide rule shown in Fig. 2.

Scales A, B and C are out in one piece forming the movable scale of the slide rule and D the fixed scale. A swinging arm is fastened to the center of the rule and in starting both scales are set at O. The swinging arm is then moved on Scale B to the figure indicating G of the formula, and held there. The movable scale is then revolved until its zero coincides with the swinging arm. This arm is then moved on Scale A to the figure representing W of the formula and held there.

The movable scale is then revolved until its zero coincides with the swinging arm. This arm is then moved on Scale C to the figure representing C of the formula. Scale D will then show the square feet of steam radiation required.

If a gravity hot water system is used this result should be multiplied by 1.5 to obtain the required square feet of hot water radiation. If a forced circulation is used this ratio may be reduced.

Speaking of the different conditions constantly found in the construction of buildings, Prof. Thorkelson calls attention to the fact that the solution of heating problems must necessarily be reached partly by rational and partly by empirical methods, and adds:

"As the loss of heat from a building occurs both by radiation and convection, and varies directly as the difference in temperature between the interior and exterior of the building, most methods of determining the artificial heat required take these factors into account.

"Although a test may show the radiation loss through a certain 12-in. brick wall to be one-third of a B. T. U. per hour per square foot per degree difference in temperature, still the care with which brick walls are built, the character of the brick, etc., will so affect radiation that it would be unwise to depend absolutely on this experimental coefficient, and all heating calculations must consider such variations in construction in applying experimental data.

"The heat loss due to convection will

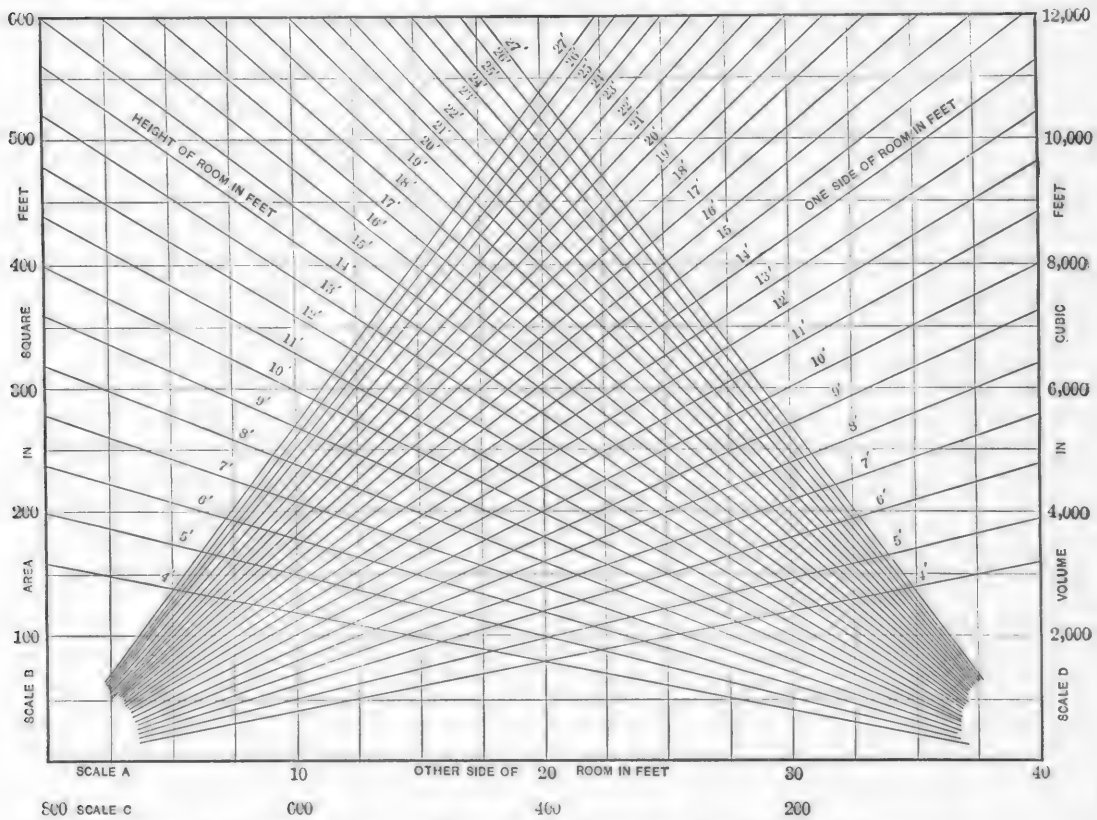


FIG. 1—CHART FOR DETERMINING AREAS AND CUBIC CONTENTS.

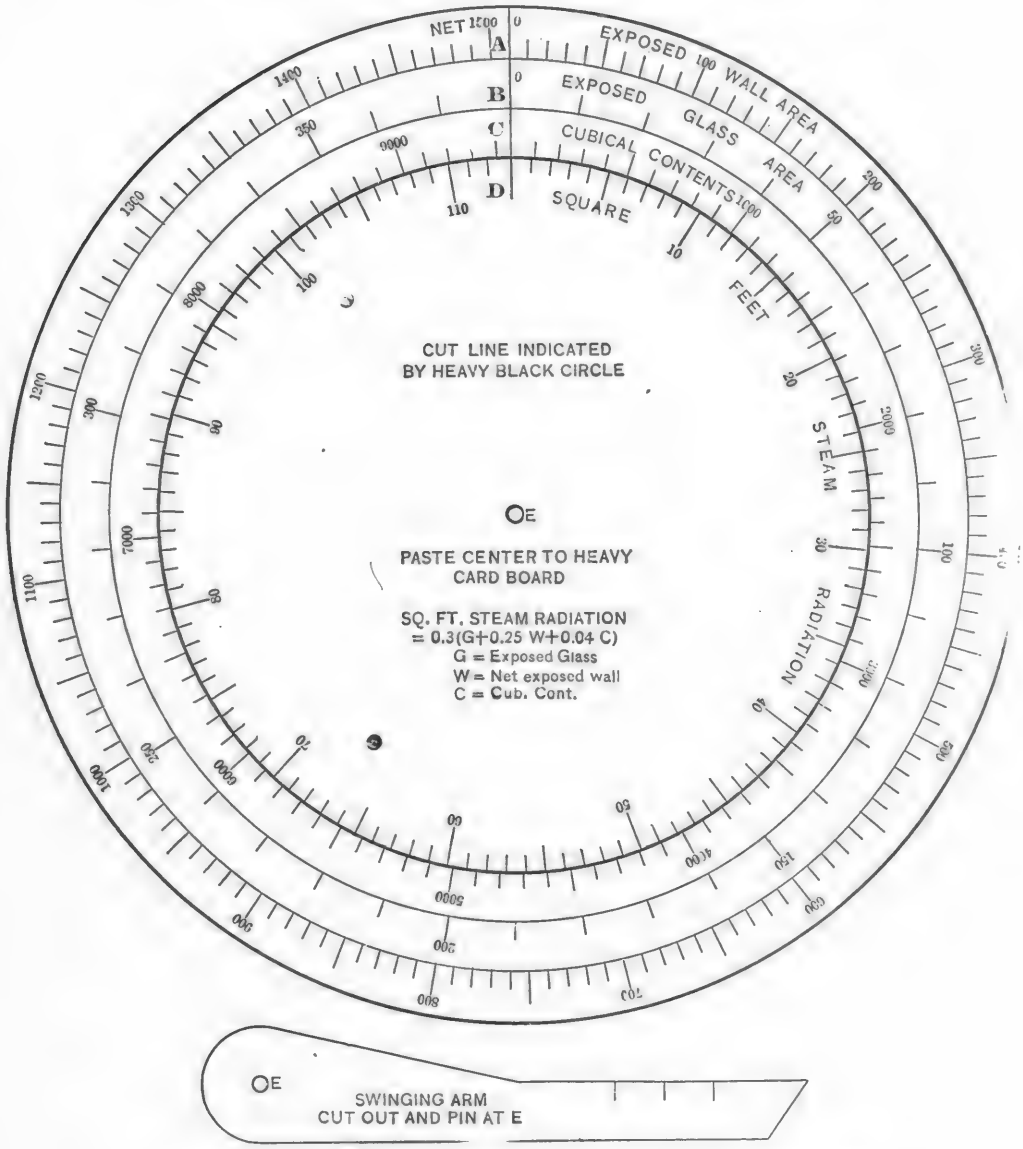


FIG. 2—CIRCULAR SLIDE RULE FOR FIGURING RADIATION.

depend upon the number of changes per hour of the air in the building and this will also depend upon its construction, use, and methods of ventilation. Although information is available for calculating such losses, still it is necessary to make ample allowances for faulty window construction and other variables.

"In this latitude (Wisconsin) the approximate average annual cost of heating a building will vary from 20% to 30% of the first cost of the heating system, if steam is used, and because of this ratio it is certainly poor economy to install cheap equipment of inadequate capacity. Unfortunately, competition between contractors and poor judgment on the part of owners and their advisers result in attempts to reduce first cost of a heating system without due consideration of the resulting effect upon operating costs and the operation of the system under severest conditions."

A Simple Method of Testing Air for Carbon Dioxide

By A. C. Norris,

CHEMIST FOR DEPARTMENT OF HEALTH, ROCKFORD, ILL.

During the past year, while serving as chemist for the Department of Health of Rockford, Ill., the writer has tested the air for carbon dioxide and relative humidity in hospitals, school rooms, gymnasiums, county jail, city jail, street cars, street car waiting rooms, hotels, office buildings, theatres, skating rinks, crowded 10-cent stores, postoffices, moving picture shows, churches, private residences and lodge rooms. As a result of this rather promiscuous work the public in general has been aroused in regard to the quality of air in its favorite church or theatre. Men have sent in requests to have the air tested in their stores or offices. Church janitors have asked that tests be made of the quality of the air that they are giving their congregations.

The writer has met with no opposition in gaining admission to any place where he desired to make a test. On the other hand, he has made many friends by informing proprietors that they were breathing dangerous air.

THE APPARATUS.

Use is made of a very simple apparatus and chemicals. A saturated solution of limewater is neutralized with the carbon dioxide of the air. The chemical reactions are as follows:

Lime from marble ($C_a O$) + water ($H_2 O$) = lime water [$C_a(O H)_2$].

Carbon dioxide ($C O_2$) + water ($H_2 O$) = carbonic acid ($H_2 C O_3$).

Lime water [$C_a(O H)_2$] + carbonic acid ($H_2 C O_3$) = calcium carbonate ($C_a C O_3$) + water ($H_2 O$).

To make the limewater, 1 oz. of lime from marble is put in 8 oz. of distilled water and shaken thoroughly. The undissolved part is allowed to settle, and a little care is needed not to disturb the clear solution when using it.

To make a test solution, 400 cubic centimeters of distilled water is put in a 500 cc. volumetric flask and five drops of a 1% solution of phenolphtholein added, or a U. S. P. solution will answer as well. Now the distilled water has some $C O_2$ dissolved in it, so one should cautiously add from a pipette a few drops of limewater until a faint pink remains after a thorough shaking.

Next use a Mohr's 5 cc. pipette to add the limewater. Put in the 5 cc. of limewater and then fill to the mark with more distilled water.

If you do not wish to make 500 cc. you may make less, using 1 cc. of limewater for each 99 cc. of distilled water. Either use a burette or Mohr's pipette to measure the limewater. By all means do not blow into the bottle.

HOW THE APPARATUS IS USED.

To test the air, use a glass tube 1.5 centimeters in diameter and about 25 centimeters long, a wooden demonstration hydrometer, graduated in centimeters, 1 centimeter square and 30 centimeters long. The hydrometer simply acts as a plunger to drive out the old air and let in new air. A 50 cc. centimeter Nessler tube answers very well indeed for the glass tube.

Find the volume in cubic centimeters of the glass tube. Put 10 cc. centimeters of the red limewater solution in the tube. Evidently there is the volume of the tube less 10 cc. of air in the top of the tube. Place the thumb over the end of the tube and shake twenty-five times. If the color has not disappeared stick your plunger into the rod until say 20 cc. of air have been forced out and then remove and let air from the room enter. Shake as before and note color. Use a piece of white paper as a background. Keep adding less air each time until the lime water has become colorless or, in other words, has been neutralized by the carbonic acid formed by the carbon dioxide of the air and the water in the solution. Now add together the various amounts of air and record them and compare with the table which follows:

PRECAUTIONS TO BE OBSERVED.

A few precautions are necessary:

1. When you are through testing the

air and wish to make another test, work your plunger up and down several times in the tube to fill it with air in the room,

2. When removing the plunger be careful to hold the top of the tube away from your mouth so as not to fill it with expired air.

3. Carry your test solution in small 2-oz. bottles, so that you will not contaminate your whole supply with the bad air of the room you are testing.

4. This solution should not be over 6 hrs. old when used.

The table given below is one given in the National Biology Notebook, published by L. E. Knott Apparatus Co., Boston, Mass.

SOME FACTS GLEANED FROM EXPERIMENTS PERFORMED.

Outside air, 0.04% CO_2.

Good inside air, 0.06% CO_2.

Air giving slight headaches, 0.07% and above.

Air unfit to breathe 0.10% and above.

Air often found in theatres and moving picture parlors 0.15% and above.

Air in a jail cell, 0.22%.

Expired air from lungs 4.40%.

This test is very simple and accurate and may be made in from 5 to 15 minutes, depending on the quality of the air.

With a hygrodeik along to take the temperature and relative humidity of the air, a sanitary inspector may easily visit five or six places an hour and make a full report to his superior officer.

These reports, when published in the daily newspapers, have produced very good results here in Rockford and no doubt, ought to have equal effect in other cities of the same size.

Air required to produce discoloration in 10 cubic centimeters of 1% limewater solution, cubic centimeters.	Per cent. of CO_2 in air
207	0.04
165	0.05
138	0.06
118	0.07
103	0.08
91	0.09
82	0.10
75	0.11
69	0.12
64	0.13
58	0.14
55	0.15
52	0.16
49	0.17
46	0.18
44	0.19
42	0.20
39	0.21
36	0.22
35	0.23
34	0.24
33	0.25
32	0.26
31	0.27
30	0.28

Air Impurities—Dust, Fumes and Gases

By Charles Baskerville.

In the field of factory ventilation, it is well known that the nature of the industry usually determines the type of ventilation system to be used. In addition, however, it is essential that the ventilating engineer shall know the character of the dust, fumes or gases, as the case may be, that he is called upon to dispose of. These impurities were discussed in detail at the recent National Conference on Industrial Diseases at Atlantic City by Prof. Charles Baskerville, of the College of the City of New York. As classified by Prof. Baskerville they consist of (1) dusts, (2) fumes, and (3) gases.

These divisions are not exclusive, as fumes in abundance may become dusts; for example, a sudden escape of white arsenic fumes results in a cloud of dust. Again, smelter fumes (mainly sulphur dioxide), much diluted, may be classed as gaseous. The classification, therefore, is neither specific nor dependent upon inherent properties of the materials. It is merely a convenience and must admit of a broad and liberal interpretation.

INDUSTRIAL DUSTS.

It is well known that various industrial dusts cause irritation of the respiratory passages and of the eyes and skin of workmen. Such dusts may be considered in three classes, namely:

1. *Insoluble inorganic dusts.*—This class includes metals (antimony, arsenic, type-metal, brass, bronze, copper, aluminum, iron, steel, lead, manganese, vanadium and ferro-vanadium, silver, tin, zinc, and solder) in a state of fine division (dusts, atomized metals, metallic powders); flue dusts; various ore dusts

(iron ore, etc.); silica, sand, emery, flint, glass powder; carbon, graphite, diamond, coal, soot; brick dust, marble, granite, cement, terra-cotta; lime, gypsum, plaster, meerschaum; phosphates, guano, etc.

Fibrosis of the lungs may result from the inhalation of silicious or metallic particles; for example, we have "potter's asthma" and "grinder's phthisis" (chronic catarrhal bronchitis among knife-grinders). Pneumonia has been reported as frequent among workmen in blast-furnaces, in part owing, directly or indirectly, to the inhalation of slag dust; cardiac dilation is said to occur among workmen in slate quarries; ankylostomiasis among brickmakers, miners, etc.; and recurrent inflammation of bone with hypertrophy among pearl-dust workers.

METAL WORKING A DANGEROUS OCCUPATION

Hellthaler has shown the high rate of death among various classes of metal workers in America who are apparently in ignorance of the peculiar dangers of their occupations; and Prinzing has demonstrated the high death rate from phthisis among steel grinders and other workmen at Solingen, Germany, for the years 1885 to 1895.

It is certain that the inhalation of iron dust may diminish in time the respiratory efficiency of the lungs through a loss in their elastic property; or may reduce the resistance of the organs to invasions by harmful bacteria; or may infect the lungs through a transportation of disease germs to places favorable for their inoculation.

The disease known as siderosis exists commonly among metal polishers, knife-grinders, and others engaged in metal working. The earliest symptoms of this disease are, according to Soper, catarrh and bronchitis, but shortness of breath is pronounced by all authorities to be the most characteristic symptom. Eventually there follows what appears to be phthisis without the presence of tubercle bacilli, yet genuine infective phthisis is the most common cause of death.

The effects may be delayed for years, but metal working is indeed a dangerous occupation; undoubtedly many die from infectious pulmonary diseases who do not know that the breathing of dusty air has led to their infection.

IRON DUST IN SUBWAYS

With the development of rapid transit systems in modern cities, it may be well to direct attention to a new and specific form of city dust investigated by Dr. Soper, who found that the average weight of dust in subway air was 61.6 mg. per 1,000 cu. ft. of air, or 2.25 mg. per cu. meter. The figures for the streets were 1.83 mg. per cu. meter. The subway dust was found to consist chiefly of angular particles of iron, but no case of siderosis seemed to have been reported.

2. *Soluble inorganic dusts.*—This class comprises such substances as are likely to be swallowed and absorbed, and includes: metal particles (lead, brass, copper, zinc, arsenic, mercury, and silver) and soluble inorganic salts. Many dusts of this class are dangerous, not only because of their irritating or poisonous properties, but also because of their inflammability—e. g., potassium chlorate.

3. *Organic dusts.*—This class comprises sawdust, fur, skins, feathers, broom and straw, grain and flour, jute, flax, hemp, cotton, wool, carpet dust, street sweepings, tobacco and tobacco-box dust, hides and leather, felts, rags, paper, horsehair, etc.

As representative diseases caused by organic dusts we have: "flax-dresser's disease," a kind of pneumonia due to the inhalation of particles of flax; pneumokoniosis due to the inhalation of dust by gannister workers; alkaloidal poisoning from African boxwood by workmen engaged in shuttle making; and malignant pustule and a febrile disease among rag-sorters. As in the other classes, the components of this class of dusts are all irritating to the respiratory tract and to the eyes, and especially are they capable of forming inflammable, and even explosive mixtures with air. In addition, there are various trade eczemas, and anthrax has been frequently reported among wool-sorters.

METHODS FOR PREVENTING DISEASE FROM DUST

The solution of the industrial dust problem presents many difficulties. Undoubtedly, however, disease from dust may be much reduced by the following procedures:

(a) Those engaged in the following

occupations should wear "workmen-respirators": sorting rags in paper factories; workmen on threshing machines; millers; batch-mixers in glass factories; stone-cutters and sculptors; and all those working in factories where the air is contaminated with irritating or poisonous dust.

(b) Those employed in the manufacture of oxidizing agents and lead workers should be compelled to change their clothes before leaving the factory. This is done now in some works in this country.

(c) Glasses for the protection of the eyes of workmen should be looked upon as necessary in plants where irritating dusts are unavoidable.

(d) The dust on the floors of printing, type-casting, metal-working, and other establishments may be laid by means of certain useful preparations. Heise considers those consisting entirely of non-drying (mineral) oils to be the best for the purpose.

Where vapors are likely to ocassion industrial poisioning, ventilation will serve to prevent their accumulation; but in the case of dusts, economic considerations often render such a procedure difficult except, of course, as the maintenance of normal ventilation assists in their elimination.

NOXIOUS FUMES, GASES, AND VAPORS.

The air of cities and towns where chemical manufactories exist is often contaminated with noxious gases of industrial origin which are dangerous to the health of the workmen employed in the industries. The usual gases which give rise to complaint in manufacturing localities are the following: chlorine, which is emitted by pottery kilns and ceramic-products manufactories, and from plants for the electrolysis of halides; hydrogen chloride, which is produced by the combustion of coal, and by pottery kilns, ceramic-products manufactories (partly from the coal and partly from the clay), nickel and cobalt smelting, platinum refining, glass manufactories, fertilizer manufactories, the chloride of lime industry, and alkali manufactories; sulphur dioxide and sulphuric acid, which result from the combustion of coal, coke, petroleum, and gas, copper smelting, bleaching operations, etc.; fluorides and hydrofluoric acid, which are emitted from acid phosphate and heavy chemical plants; hydrogen sulphide, from chemical works, especially those which produce ammonia; carbon monoxide, which is emitted from iron furnaces and from copper smelters; organic vapors, from, for example, glue refineries, bone burners, slaughter and packing houses; zinc fumes from zinc smelters and from brass foundries; arsenical fumes from copper smelters; phosphoric fumes from match manufactories; and carbon disulphide and sulphur chloride from some rubber works.

Of the gases which affect the respiratory passages and eyes the most important are the following: illuminating gas, gases from coke and coal; carbon monoxide; carbon dioxide (in brewing, baking, and the manufacture of aerated waters); chromic acid; chlorine, sulphuric, hydrochloric and nitric acids, and nitrogen oxides (in acid factories, heavy chemical works, engraving, etching, lithographing, etc.); mercury cyanide; heated lead; ammonia; naphtha and benzine (petroleum refineries and dry-cleaning establishments); arseniuretted hydrogen (copper refineries); sulphur, hydrogen sulphide, sulphur dioxide, and carbon disulphide, sulphur chloride, nitrous gases, hydrocyanic acid; smoke (fire extinguishing); and the vapors of various organic compounds an dsubstances (tar, creosote, carbolic acid, petroleum and its products, methyl alcohol, fusel-oil, varnish solvents, dinitrobenzol, nitroglycerine, formaldehyde and formic acid, pyridine, etc.).

Carbon monoxide occurs in colliery workings after explosions, in gas producers, blast-furnace gases, and in the manufacture of calcium carbide and phosphorus; hydrogen sulphide occurs in gas-liquor storage tanks, gas purifiers, sulphate stills and saturators, and in sewers; chlorine is found in and about bleaching-powder chambers, manganese stills, and Deacon and other chloride plants; and nitrous and nitric acid fumes, which are very insidious in their action, are met with in vitriol chambers, especially in Gay-Lussac towers, during repacking and cleaning, in the manufacture of nitrate of iron and nitric acid, and in all breakages of vessels containing nitric acid.

Effects of Confined Air Upon the Health of Workers

By George M. Price,

NEW YORK STATE FACTORY INVESTIGATING COMMISSION.

Supplementing the convincing arguments that are being advanced showing the interest to the employer, from an efficiency standpoint, in maintaining healthful conditions for his employees, a report of a physical examination of 1,413 workers in two typical industries has been made by George M. Price, of the New York State Factory Investigation Commission, and were reported by him at the recent Conference on Industrial Diseases at Atlantic City.

In this investigation a distinction was made in connection with the term "confined'" by which is meant air confined and vitiated by such impurities due to respiration, combustion, illumination and overcrowding. Thus the investigation is to be distinguished from those which have taken into consideration extreme variations in pressure, humidity and temperature and from those where dusts, poisons, gases, fumes and infective bacteria are factors.

Dr. Price reported that in an examination of 4,850 establishments in New York State no means of ventilation, except by windows, was found in 88% of the shops. The air in all of these was confined and vitiated.

"There is as yet," says Dr. Price, "a difference of opinion as to the exact nature of the toxicity of confined air. There is, however, no difference of opinion as to the dangers to health of a continuous and constant inhalation of such air.

"Confined air does not produce distinct pathological lesions, nor does it directly cause any diseased conditions; and therefore its influence on the death rate is difficult to prove. The best method for studying the effects of confined air upon the health of workers is to study the comparative morbidity rates of workers in different occupations who habitually breathe stale air in the course of their several employments.

"In an effort to determine the effects of confined air upon workers it would be valuable to have a comparative table of the prevalence of anemia, bronchitis, and digestive diseases among workers in various indoor occupations. Unfortunately, such data are unavailable in this country. The only way by which the facts may be gathered is by a physical examination of a large number of workers in different trades. It has, therefore, occurred to me that it may be of value to present some results of a physical examination of workers in two different industries, which it was my privilege to conduct during the last year.

"Dust was found in bakeries as well as in tailor shops. With the present methods of baking, however, the effect of the floor dust is unimportant as very little is allowed to escape. The vegetable and animal dust found in cloak shops was not sufficient in quantity to cause serious injuries. In the bakeries the temperatures near the ovens were rather high, but this affected only a comparatively small number of workers. The amount of CO_2 in bakeries and cloak shops does not differ very much. According to Dr. C. T. Graham-Rogers, who has made examinations in the shops of both industries, the amount of CO_2

RESULTS OF THE PHYSICAL EXAMINATION OF 1,413 WORKERS IN CELLAR BAKERIES AND IN SOME OF THE BEST TAILOR SHOPS IN NEW YORK CITY.

	Bakers		Tailors	
	No.	Per cent.	No.	Per cent.
Total examined	800	100.0	613	100.0
Free from disease	347	43.4	115	18.8
Had the following diseases:				
Anemia	183	22.9	158	25.8
Asthma	21	2.6	9	1.5
Bronchitis:				
Acute	177	22.1	19	3.1
Chronic	..	..	36	5.9
Laryngitis	..	..	5	0.8
Pleursy	2	0.3	4	0.7
Tuberculosis:				
Positive	19	2.4	4	0.7
Suspected	..	..	7	1.2
Diseases of the digestive system	76	9.5	186	30.3

in the air ranges from 6 to 25 per 10,000 volumes, and does not differ very much in the two industries.

"The sanitary conditions of the cloak shops in which workers have been examined were exceptionally good, as these belonged to certificated shops in the industry. All the cloak shops examined were ventilated, however, by means of ordinary windows and, although not overcrowded, the ventilation of all the rooms was defective because the windows were closed and no special provision was made for introducing fresh air. The bakeries examined were all underground with no provision for ventilation except through small windows or gratings, but owing to the heated ovens the change of air was probably not less than in the tailor shops.

"The standard mentioned by Hoffman of the incidence of 15.5 diseases to ten persons, being the German rate, can be compared to the 950 diseases for the 613 tailors examined, which makes a ratio of 15.5 to 10.

"The large number of bakers suffering from bronchitis, in comparison with the number of tailors suffering from that disease, seems to indicate the better sanitary conditions of the tailor shops, which, as has been noted above, belong to those that have received sanitary certificates from the Joint Board of Sanitary Control. On the other hand, the comparatively large number of digestive diseases among tailors may perhaps be due to their stooping posture and to their lesser muscular activity as compared with bakers, who are always on their feet and who change the character of their work a number of times during the day, while tailors sit at a machine for nine hours a day with only a single interval of relaxation.

"It seems to me that the comparatively high percentage of anemia, bronchitis, and digestive diseases noted among both the bakers and the tailors is at least suggestive of the defective ventilation of the shops in these industries, and that the confined air which bakers and tailors are compelled to breath habitually has a stronger etiological relation to these diseases."

DISCUSSION.

DR. LEE K. FRANKEL: The discussion here has centered largely around what might be done in the direction of preventing disease through efficient legislation and by the employer of labor, but nothing has been said about what can be done by the workman toward safeguarding his own healtth. I want to mention what has been done in the city of Vienna, where there is a federation of sick clubs, under the Austrian government, which records every disease that occurs among its members, and these clubs practically comprise every workman earning a certain income. Every member realizes that it is for his distinct advantage to report the conditions that exist in the factory where he works, particularly with reference to accidents. The result is that in the central bureau there is a careful record of every industrial establishment in the city of Vienna reported under the very best form of factory inspection known, namely by the employee himself, and by moral suasion without the necessity of legislation. These clubs have gone to the employer who has not introduced proper safeguards against accidents, or who has not put his mill or factory in good sanitary order, and have shown him that his establishment is below the standard, or proved to him that more accidents occur in his establishment than in those of his competitors. By this method they have been able to raise the standard exceedingly. Lacking compulsory industrial insurance it seems to me that, if this problem were taken up by our labor organizations, they could institute a system similar to that in vogue in Vienna and bring home to their employers the need for putting their factories in proper condition.

MRS. IRENE OSGOOD ANDREWS: I want to say a word as to the relative value of protection from bad ventilation and protection from disease. Ventilation is a much bigger problem and covers a larger number of persons, and we should be delighted to know what to do about it. We knew, after some study, what was an effective remedy for phosphorus poisoning; we knew after a while about compressed-air illness, about lead poisoning, and something about blindness from wood-alcohol; but we don't know what to do about ventilation. Illinois passed in 1909 perhaps the most effective law, yet I am told that it is only indifferently enforced. The occupational disease law passed last year has met with greater success. Massachusetts has had medical inspection factories for six years, but Massachusetts has no standard for ventilation. New York has had medical inspection for four years, but has no standard for ventilation. Those of you who are familiar with New York conditions know that for three years we have been having conferences on ventilation. Last year a bill was proposed and this year the experts disagreed entirely and the bill was cast out. Anyone who can give us information on how to handle effectively and enforcibly this subject of ventilation awaits a place in the hall of fame. We hoped that might be one outcome of the meeting here.

DR. C. T. GRAHAM-ROGERS: It is true that experts on ventilation, instead of agreeing, have disagreed, and that the whole subject is in rather a chaotic state, probably because there has not been strong enough co-operation on the part of engineers, physiologists, medical men, and factory workers to get results.

There are so many factors entering into the question that I doubt if six months or a year will give us much of a clue to its solution. It will take several years of intensive investigation. But we cannot have any standard ventilation for all industries; each industry stands by itself and in each intensive research must be pursued. We shall get results, not now, but in the future.

PROFESSOR C.-E. A. WINSLOW: I face the logical conclusion: If the only problem is overheating we can do without ventilation. But aside from the heat question, we have to change the air in order to remove the odors, the dust, and the fumes. Whether they hurt or not they have to be removed. And we have to have tempered air. In a hospital you can do what you want with patients, but in a factory you cannot have the people making complaints, so the windows have to be shut, and I doubt if it would conduce to the efficiency of the industrial worker to do otherwise.

Ventilation for Telephone Booths.

There are fourteen telephone booths at the South Station, Boston, Mass., that are ventilated by Sturtevant ready-to-run electric blowers. As these booths are used constantly, this mechanical ventilation is in operation whether the door of the booth is open or closed. The superior quality of the air in these booths is very noticeable to the person occupying them. The booths are arranged in two groups of seven each, each group being ventilated by one Sturtevant "D" size ready-to-run ventilating set. This is placed upon the top of the end booth and blows directly into a fibre pipe which runs over the top of the booths, as can be seen in the illustration. From this pipe there are discharge pipes, delivering the air to the booths through deflectors especially designed to prevent the blowing of air directly upon the head of the occupant of the booth.

An exit for the air from the booths is provided in the doors. A brass ventilator is placed in the bottom of the inside door and in the top of the outside door, so that the air leaving the booths at the bottom, enters the dead air spaces between the doors and is finally discharged at the top. In this way, the transmission of sound is prevented. The fan and motor operate quite noiselessly.

The fan operates at 850 R.P.M. and delivers 450 cu. ft. of air per minute, or 64 cu. ft. to each booth, changing the air in the booth about every minute. The system is patented and was built and installed by the B. F. Sturtevant Co., Hyde Park, Mass.

Visit to Testing Laboratories.

As the result of a call made upon Prof. Breckenridge, of the Sheffield Scientific School by James A. Donnelly, who is chairman of the committee on tests for the American Society of Heating and Ventilating Engineers. an invitation has been extended by Prof. Breckenridge to have the committee on tests, as well as members of the New York and Massachusetts Chapters of the society visit the Mason Laboratory of the Sheffield Scientific School at New Haven, Conn., December 13. There the methods of testing heating apparatus employed by the laboratory will be explained by Prof. Breckenridge and suggestions solicited for making future tests.

An invitation has also been extended by the H. B. Smith Co., of Westfield, Mass., to have the party visit its plant at Westfield, Mass., and inspect the company's methods of testing boilers and radiators.

TELEPHONE BOOTHS AT SOUTH STATION, BOSTON, EQUIPPED WITH VENTILATING APPARATUS.

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IN MORE than one quarter is heard the remark that the future will not see as many installations of mechanical ventilation systems as in the past. This prophecy is based on the present discussion among physiologists, as well as heating engineers, as to the qualities of fresh air and the present methods of obtaining same in closed quarters. Such a fear is bound to arise when doubts are successfully cast upon any well-established practice. Yet we venture to say that the profession, as well as the trade, will adjust itself to the new conditions with increasing prestige and profit. Indeed, it begins to look as if the present and proposed regulations for the ventilation of public and semi-public buildings will open up fields where hitherto the ventilating engineer has been quite unknown. Thus, while the use of elaborate ventilation systems may very likely decrease in certain types of buildings, such as hospitals and, possibly, school buildings, their compulsory installation in a large class of buildings under the control of State and city inspection bureaus will be sufficient to engage the attention of the trade for many years to come. In other words, the principal difference in the future will be in the character of the installation. And it must be remembered that much of the same agitation over present practices is responsible for the greatly-widened field for business that must come with the passage of the pending legislation on this subject.

It is a most significant thing that three of the largest States in the country, Illinois, Ohio and New York, are now considering what really amount to compulsory ventilation laws, which, if passed, will require mechanical ventilation equipment in practically every class of building where people are gathered in appreciable numbers. It goes without saying that much of this work will call for new methods. Nevertheless, in most cases it will require the services of experts and the wise and successful engineer will be the one who keeps in touch with these requirements and, rather than decry the efforts of the physicists, adds their qualifications to his own. The information contained in Prof. Baskerville's paper, in this issue, is a striking illustration of this point.

THE PROPOSAL for a national ventilation commission is a logical sequence to the "fresh air" movement and the idea will be welcomed by all who have the interests of the profession at heart. The possibilities in the formation of such a commission are very inspiring, especially if it were backed up with the necessary funds for conducting tests and making other desired investigations. The likelihood of such support is intimated in the announcement of the plan. Further details will be awaited with the greatest interest.

THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

5—Location of Air Inlets and Outlets.

QUESTION—What are the proper positions for inlets and outlets for air supply and vents for classrooms and auditoriums?

ANSWER—There is considerable difference of opinion on this question. It all depends on the density or weight of air, which varies inversely as its temperature, whether fresh or foul. When heating alone is desired, the entering air must be warmer and lighter than the air of the room and the outlets should be at the bottom. When the occupants exhale air and bodily heat is radiated, the foul air of any room containing a large number of people per cubic contents is lighter than the incoming air, and the outlets should be at the ceiling. For a perfect system, both top and bottom ventilation should be provided.

A register at the top of the room should automatically close when the room is below the temperature of the incoming air and open when conditions are reversed. The register may be operated in conjunction with automatic heat control on direct surface in the room or on the auxiliary stack.

In school work, the size of the ordinary classroom and the frequent air change required prevents any wide difference in temperature in the room, and the top register is generally dispensed with. The best practice is to heat the room by direct radiation, independent of the air supply.

In large auditoriums, with high ceilings, the top ventilation is absolutely necessary. The bodily heat is sufficient to raise the temperature in conjunction with that of the incoming air and the fresh air falls to the floor or lower level without causing drafts. The foul air, being lighter, is then taken through a large ventilator in the ceiling. This condition is reversed when the building is cold and heat is required, with no audience present.

As to the position of the inlets and outlets with regard to the sides of the room, it makes little difference if the velocities are low, except that flues should not be placed in outside walls. The level and differences in temperature are the all-important points.

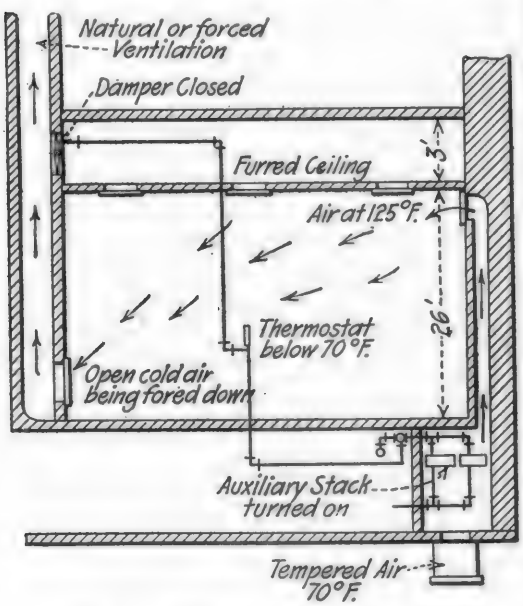


FIG. 1—POSITION SHOWING ROOM HEATING UP.

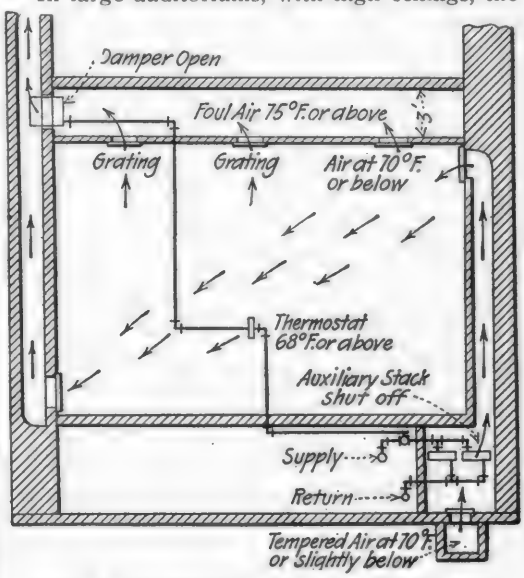


FIG. 2—POSITION OF DAMPERS AND STACK WHEN ROOM IS FULL OF PEOPLE.

6—Cause of Failure of Fan System to Heat School.

QUESTION—An illustration was used recently of a large school building that would not heat in weather 10° above zero without the addition of the direct radiation, even with the entering air at 186°F. and the air leaving the indirect stacks at 230°. It is stated that after operating the fan system in conjunction with the direct radiation, the school was both heated and ventilated satisfactorily. Can you tell why these high temperatures were necessary, and why it was not possible to heat the building during sessions without the direct radiation?

ANSWER—This might lead a layman to suppose that this condition applied universally, which is not the case. The requirement that the entering temperature of the air be 186°F. showed that the ventilating system was entirely inadequate for heating or ventilation, and it is impossible to see how it could give satisfaction. It is customary, in all well-designed school plants, to supply sufficient air so that, with a rise of 5° or 10° in the temperature of the incoming air, the thermostats will automatically shut off all direct radiation during sessions. A few figures will show that the air supply in this particular school was inadequate or that the air was curtailed sufficiently to destroy its use for ventilation in order to obtain the high temperatures stated of 230° in the ducts and 186° entering the room.

This condition might be aggravated by the improper positions of the inlets and outlets, the excessive high temperatures preventing the air from diffusing and giving up its heat. The statement that the air was 230° leaving the stacks shows that the air supply was curtailed or did not exist, as there would not be boiler power enough in the ordinary school to furnish the steam.

The writer has a school in mind requiring 60,000 cu. ft. of air per minute and boiler power to raise it from zero to 90°, which is sufficient to heat the school without the direct radiation in the coldest weather.

$$\frac{60{,}000 \times 60 \text{ min.}}{55{,}000 \text{ cu ft. air}} \times 90° = \frac{5891.4}{34} = 173.3 \text{ B. H. P}$$

55,000 cu. ft. of air raised one degree requires the latent heat in 1 lb. of steam at atmosphere, approximately. If this air were raised to 230°, it would require 230÷90, or 2.55 times the boiler power, or 433 H.P., which would be about twice what would be installed in the largest school.

We will assume a class-room 30 ft.×25 ft. ×12 ft. high, capable of seating 50 pupils and containing 120 sq. ft. of direct radiation under thermostatic control, in addition to the fresh air supply. The normal air supply in a well-designed plant for this room would be 1,500 cu. ft. of air per minute, or 30 cu. ft. per pupil. 55 cu. ft. of air requires 1 B.T.U. to raise it 1°, and we will assume 250 B.T.U. per hour per square foot as the capacity of the direct radiation.

The room contains 9,000 cu. ft. of space and 1,500 cu. ft. will give an air change once in 6 min. or 10 times per hour.

$$\frac{1{,}500 \times 60 \text{ min.}}{55 \text{ cu. ft.}} = 1{,}636 \text{ B.T.U. per hour for}$$

each degree the air is raised above the temperature of the room, or 70°. 120 sq. ft. direct radiation × 250 B.T.U. = 30,000 B.T.U. per hour, which is the capacity of the direct radiation. 30,000÷1,636 = 18.3° for the incoming air, or 89° will heat the room in extreme weather without the direct radidation, with a proper distribution. This does not take into account about 240 B.T.U. per hour thrown off by each pupil in animal heat.

If the incoming air was 186°, the air supply required would be 186° — 70°, or 116° above the temperature of the room and 18.3÷116× 30 cu. ft. = 15.8% of 30 or about 5 cu. ft. per pupil as the air supplied in the example cited. This could hardly be called ventilation.

The above discussion shows that this school could hardly have been satisfactory from any standpoint and was certainly not a proper example to illustrate how to properly heat and ventilate a school, even after the author's recommendations were adopted.

7—Water Heaters for Vacuum Heating Systems

QUESTION: Can you tell me how to design water heaters for vacuum heating systems?

(a) Ratio of the heater and vacuum pump.

(b) Ratio of heater and total surface of all radiators used, direct heating.

ANSWER: Again the above ratios have nothing to do with one another. If a heater is designed for domestic water service to operate on very low pressure steam, it is simply a question of the rate of transmission of heat for the heater between the temperature of steam used and water required in gallons per hour. This will be about 240 B.T.U. per square foot per hour, but the velocity of water will depend a good deal on the arrangement of the surface, whether brass or iron. It is policy to consult some of the feed-water heater manufacturers in a case of this kind and find out what each can do with his particular type of heater.

The same is true of question (b). The radiation has nothing to do with the transmission or size of heater directly. The load in B.T.U. is dependent on the amount of heating surface and its temperature. The surface in the heater depends on the temperature of the steam and transmission, which varies if on forced circulation, with the pumpage and

with the drop in temperature on the job. The question cannot be answered generally, as each individual case has to be considered by itself.

Health and Ventilation.

A DISCUSSION OF THE VIEWS EXPRESSED BY LEONARD HILL, M. B., F. R. S. BEFORE THE PHYSIOLOGICAL SECTION OF THE BRITISH ASSOCIATION.*

The principal points made by Leonard Hill, M. B., F. R. S., in his address before the Physiological Section of the British Association were discussed in *The New York Times* of November 3, 1912, by William J. Baldwin, Jr., of New York, the same issue containing Dr. Hill's reply, in which he reiterated his views on the subject of impure air.

Referring to Dr. Hill's experiments, in which he kept seven or eight students confined in an air-tight chamber for half an hour without unpleasant results so long as the air was kept in motion, Mr. Baldwin states:

"It does not appear conclusive that because the students did not experience headaches or become unconscious within the half hour, the impure air of the enclosure was not unhealthy. If the occupants had remained confined a very little longer without a supply of fresh air, every one of them would have died as surely as those unfortunates did in the Black Hole of Calcutta, and other similar world-wide disasters of its kind. If one had survived, he might have suffered like the few survivors of that dreadful catastrophe—half-living bodies filled with infected blood, which showed in such horrible outward forms.

"Whether those blood impurities were due to infection from breathing the vitiated air filled with organic impurities thrown off by the mass of humanity, or whether it was the impurities in the individual which could not be thrown off, due to the condition of the air, is problematical, but the results were nevertheless apparent and absolutely due to the confinement in an impure atmosphere. When children in a poorly ventilated school, or adults in an ill-ventilated factory, breathe the same air which has been inhaled and exhaled by every one else in the same room, they are doing exactly what those unfortunates did during that dreadful calamity, but in a somewhat less degree.

"Until something more conclusive is shown we must adhere to what we have found by practical experience to be the effects of living in an impure atmosphere, and by an impure atmosphere we mean an atmosphere where the air is being inhaled and exhaled by many people in a room or other inclosure, and where, in addition to the decreased percentage of oxygen and increased percentage of carbon dioxide, will always be found organic matter in large quantities, together with aqueous vapor thrown off by the body, and dust and dirt in abundance, and a large percentage of bacteria which is always found in such contaminated atmosphere. This, together with the ever-present possibility of the spread of epidemic, makes ventilation absolutely necessary in all buildings where people congregate in large numbers. Therefore, we must assume that impure air is unhealthy at all times."

Dr. Hill's Reply.

In his reply, Dr. Hill maintains that the dangers of ill-ventilated places arise from two causes:

(1) Infection by pathogenic bacteria, the mass influence of which is enormously increased in confined, crowded places;

(2) Temperature, relative moisture, uniformity, and stillness, qualities of the air which profoundly influence the metabolism and health, and the immunity of the body, that is, the power to resist the invasion of pathogenic bacteria.

"I also maintain," he adds, "that the chemical purity of the air in ill-ventilated rooms, so far as regards deficiency of oxygen and excess of carbonic acid gas and the chemical organic poison supposed to be exhaled by human beings is of no importance; that attention has been wrongly directed to this instead of to the excessive temperature, relative moisture and stagnation of the air.

"Excess of carbon dioxide, that is, 1% in the atmosphere, cannot enter the body, because the respiration is automatically regulated so as to keep the concentration of carbon dioxide in the lungs constant. The only effect of breathing in atmosphere containing this is slightly to increase the depth of the breathing, just as the breathing is deepened by the production of more carbon dioxide during exercise.

BLACK HOLE VICTIMS DIED FROM HEAT STROKE

"The victoms of the Black Hole of Calcutta have died, not from suffocation, but from heat stroke. Men so crowded together in a confined space cannot keep their body temperature from rising, and the heart becomes exhausted by the febrile condition which ensues. If they survive the immediate effects they are exhausted, perhaps infected with pathogenic bacteria, and may subsequently die. In modern cities the air is confined by skyscrapers, and men live and work in dark windless places. The chemical purity of the air therein may be good, but the darkness and windless nature of the air depresses the nervous system, and is the cause of unhappiness and ill-health."

In conclusion, Dr. Hill says: "To prevent the overheating of the body and discomfort of crowded rooms, the whole treatment of such

*Published in The Heating and Ventilating Magazine for November, 1912.

rooms must be remodeled. The ventilating engineer will gain his end and the gratitude of the public, not by the impulsion of warm air so as to attain high chemical purity, but by keeping the room pleasantly cool and the air in gentle motion between the bodies of the people."

CORRESPONDENCE

Health and Ventilation

Editor HEATING AND VENTILATING MAGAZINE:

Mr. Leonard Hill's contribution to this subject, as presented in the November issue of your journal, is of general interest and, for the most part, may be accepted as sound; but in several particulars the conclusions formulated do not appear to be sound. I view this matter from the point of view of one who has spent thirty summers at an altitude of about 1,200 ft. above sea level and the balance of the year at or near sea level. I have also made some observations relating to combustion processes that are not in harmony with Mr. Hill's contentions.

The idea that high level air that is known to be of sanitary excellence may be so without reference to percentages of oxygen present is not sound. It is the pure air of high altitudes that induces health. Other things being equal, the lower the altitude at which air is breathed, with its increase of pressu over that of the upper level, the greater is the vitality and strength of the individual breather. The loss of strength due to removals from low levels to high levels is not quickly overcome. In my own case, I have to rest for weeks when I remove to my summer home, while I gain strength within an hour after I return to sea level.

Again, the process of combustion is highly dependent on the pressure, both in the generation of heat and in increasing the physiological actions in tissue changes. There does not seem to be any good reason to conclude that there is any physical difference in this connection between combustion processes in a steam generator furnace and in the human body. Good combustion in the furnace requires a good quality of air that is substantially free from CO_2. This incombustible gas is a sedative poison and its actions are difficult to observe on that account, just in the same way that the narcotic actions of tobacco are difficult to trace.

The whole race of man indulges in a habit that is distinctly devitalizing and weakening to every activity and it is the same way with air that has an undue percentage of CO_2. It is devitalizing and uses up energy wastefully in increased respiratory effort to counteract its presence.

The experiments cited were of little value. Nercosis of whatever type hides discomfort, while its devitalizing influence is not immediately noticeable to any marked extent. The sum total of such influence is carried over a long time and its clearly observable results are mostly distant, affecting the general health of the individual and his posterity. The invidious character of devitalizing influences should be better understood as a factor in their study. But, then, man is really very ignorant of such matters. His general health and capacity for happiness and work depend largely in breathing pure air, free from every contaminant that induces discomfort and also everything that devitalizes. The human body is always more or less charged with deadly poisons and is constantly making effort to rid itself of such matters. CO_2 must be classed among them.

The diffusive force of gases is helpful in preventing immediate asphyxiation from CO_2 in badly-ventilated apartments, but the force of gravity and mechanical draft are immensely helpful in diluting undue percentages of CO_2 in respired air.

It seems to me that Mr. Hill's contentions, which have been given wide publicity, should not be allowed to pass without criticism. Mr. Hill has not gone far enough in this matter to see the remote damage that is due to the breathing of air overcharged with CO_2. If he should compare the results on consumption patients of the two qualities of air he would very soon see the vitalizing differences of highly oxygenated air and of once-breathed air, having an unusual amount of CO_2. The effects of varying pressures are also to be readily noted in treating diseased conditions.

J. M. W. KITCHEN, M. D.

East Orange, N. J., November, 1912.

Report on Open-Air Schools in Brookline, Mass.

A noteworthy gain in the height and weight of children attending school in "fresh air" rooms over those of the same grade in the ordinary closed room is shown in the report of H. Lincoln Chase, M. D., chief medical inspector of schools in the town of Brookline, which has just been filed with Dr. Walter Channing, chairman of the committee on hygiene of the Brookline school committee.

This report shows that the average gain of children of the second grade in the "fresh air" room was 3.18 lbs. during the school year as compared with 2.69 lbs. in the closed room, and 1.68 in. in height as compared with 0.95 in.

In September, 1911, an experiment was

started under the direction of the medical inspector to determine by actual facts whether the use of the "fresh-air" room would show any superiority over the ordinary pipe. For this purpose a "fresh-air" room was established in the Parsons School, to which room all the children of its second grade were assigned. The plan of the experiment is outlined by Dr. Chase, as follows:

To this room (in the Parsons School) as much fresh air was admitted by open windows and doors as was permitted by a room temperature that was seldom allowed to fall below 55° F. The children were protected against cold by khaki sleeping bags, and they replaced their street shoes with suitable slippers, thus keeping the bags free from dust. At one recess a glass of pure rich milk was given each child.

In the neighboring Winthrop School the children of the same grade, the second, had the ordinary room temperature or about 65° to 68° and no milk was given them. For purposes of comparison, the weight of each child in the two sets was taken by the writer each month, October to June, inclusive, eight months in all, and the height of each child was taken at the beginning and at the end of this period. The weight and height were taken without shoes or sweaters. A monthly record of attendance was also kept in both rooms. Owing to the careful oversight of the teacher in the "fresh-air" room, no discomfort was experienced by the children, and not a single complaint was received from any parent.

In summing up the results obtained during the eight months, Dr. Chase presented the following tables:

Parsons School ("Fresh-Air" Room), Oct. 2, 1911—Average weight, 45.97 lbs.; average height, 46.13 in. June 6, 1912——Average weight, 49.15 lbs.; average height, 47.81 in.; average attendance, 96.7%; average gain in weight, 3.18 lbs.; average gain in height, 1.68 in.

Winthrop School (Ordinary Room), Oct. 3, 1911—Average weight, 46.21 lbs.; average height, 45.98 in. June 5, 1912—Average weight, 48.90 lbs.; average height, 46.93 in.; average attendance, 94.9%; average gain in weight, 2.69 lbs.; average gain in height, 0.95 in.

In summing up his report, Dr. Chase expressed his opinion as follows:

What is most important in this matter of open-air rooms is a general recognition of the urgent need of more fresh air for children while gathered together in a room. All rooms should be "fresh-air" rooms. All children need to breathe pure, cool, normally moist, moving air. It is not important whether they breathe such air because they are debilitated or because they are well. They all need it in either case.

Even if we were to confine our attention to the anæmic, debilitated and other delicate children, it would still be necessary that all the schoolrooms should have fresh air, because these delicate children are not found in groups of twenty to thirty each in a single building in a single grade, but are scattered through the grades and through all the schools, sometimes one, two or more in a room. It would cost the town of Brookline a pretty large sum of money to look after the anæmic children in separate rooms, whereas the same thing can be done at comparatively little expense by opening the windows and doors in every room in every school. We should, it is true, incidentally improve the health of the children already well, but that is a result which we would not deplore. The essential thing as to breathing in a schoolroom is the admission of air that is at all times pure, cool, in motion, and of normal moisture. These essentials are secured in the type of "fresh-air" school room that we have just had experience with.

Proposed Amendments to the New York State Labor Law.

Details of the proposed amendments to the New York State labor law, providing for the creation of an advisory board whose duties are to include the fixing of standards of ventilation for different industries, and also providing for a division of industrial hygiene and a section of medical inspection therein, have been published by the New York State Factory Commission. In both cases, it is proposed to have a ventilating engineer included in the new divisions.

The proposed amendment relating to the creation of an advisory board says that it shall be composed of "seven persons appointed by the Governor, by and with the advice and consent of the Senate, one of whom, designated by the Governor, shall during his term of office be the chairman of the board of which he is a member."

After the board has become established provision is made for five-year terms of the appointees. Appointments are to be made so that "there shall always be as members thereof a physician, a civil or mechanical engineer (ventilating engineer), an attorney and counselor-at-law, a representative of employers and a representative of employees. At least one member of the board shall be a woman."

According to the proposed bill, the advisory board is to have the power "to make rules and regulations and to fix standards, and from time to time to modify same, in order that the provisions of this chapter may be

made effective and that their purpose and intent, which is the protection of the health and safety of the employees in factories, may be fully and properly carried out."

The above-mentioned clause is designated to permit the fixing of standards of ventilation as well as other standards. The bill continues:

"Such rules, regulations and standards may be adopted to prescribe the specific means, methods or practices to carry out the purpose and intent of any provision of this chapter to specific conditions, and to fix and make definite any time, period, space, distance, height, quantity or quality prescribed indefinitely in any provision of this chapter," etc.

The bill providing for the creation of a division of industrial hygiene, together with a section of medical inspection, to be attached to the department of labor, states that such division shall be composed of five factory inspectors. These five inspectors are to be a physician, a chemist, a mechanical engineer, a fire-prevention expert, and a ventilating engineer. This division is to make special inspections of factories and manufacturing establishments throughout the State, to conduct special investigations of industrial processes and conditions, and to submit to the advisory board proposed rules and regulations and standards to be adopted.

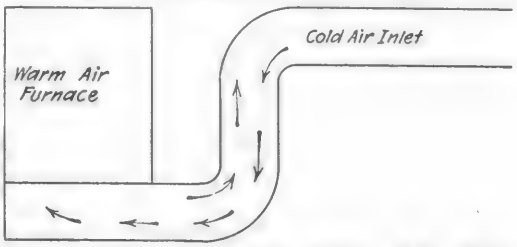
One member of this division (a physician), together with an additional inspector (also a physician), is to constitute the section of medical inspection of factories throughout the State. In order to carry these provisions into effect, the bill provides for branch offices of the commissioner of labor in New York and Buffalo, together with sub-offices in Rochester, Syracuse, Utica and possibly other cities. The number of deputy labor commissioners is increased from two to four, to have jurisdiction in two inspection districts.

Arrangement of Direct-Indirect Radiators.

Comments on the method of installing direct-indirect radiators as described in the paper on the "Ventilation of a Dispensary Building" (published in THE HEATING AND VENTILATING MAGAZINE for September, 1912), together with observations on the use of direct-indirect radiators, were brought out at the summer meeting of the heating engineers' society. S. R. Lewis discussed the subject as follows:

"I am much interested in the claim that this direct-indirect scheme ventilates satisfactorily in this building, because I have seen a great many installations of that kind, but never, up to this time, have I found anyone, unless strongly prejudiced, admit or claim that the direct-indirect radiator could be depended upon, with varying conditions, to deliver proper ventilation.

"My experience has been that when the wind blows strongly on the windward side, the warm air tends to leave the room or building, due to the partial vacuum created. It has never proven satisfactory in schoolhouse work

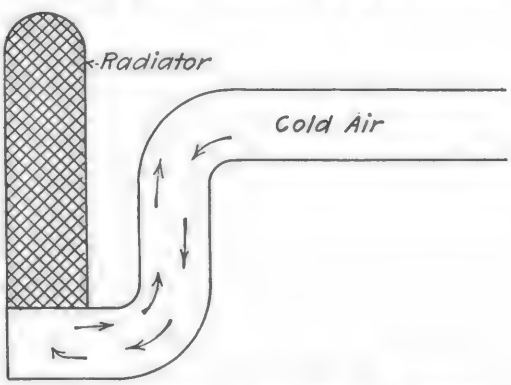


AIR CURRENTS IN COLD AIR BOX WHEN RUN TOO CLOSE TO FURNACE.

on that account. In ordinary ventilating systems we blow the air admitted for ventilation through several sections of a heater and are able to control the temperature either by by-passing the air around the heater or by cutting off some of the sections of the heater.

"With the direct-indirect method, we have to go around to the various cold air inlets and open or close each one, for there is no means of changing the amount of radiation in proportion to the air volume or temperature and no adequate means of regulating the volume of air admitted for ventilation purposes.

"Another point: those of us who have installed warm air furnaces have recognized the fact that when the cold air duct is brought along the ceiling and then dropped to the floor, so as to permit it to go beneath the furnace, we have trouble where the flue drops close to the furnace, due to the radiant heat from the furnace warming the drop flue, thus setting up an updraft which opposes the down draft of the incoming cold air. In the arrangement of the direct-indirect radiator, the illustration



AIR CURRENTS IN INLET TO DIRECT-INDIRECT RADIATOR WHEN RUN TOO NEAR RADIATOR.

indicates that the fresh air is taken in near the top of the radiator and is dropped down a galvanized iron pipe almost touching the radiator, to the floor, where it turns and rises through the radiator. In my judgment, this fresh air will not fall down the flue, because the flue is warmed by the radiator and the current of air will tend to go the other way."

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Nominations of Officers for 1913.

The nominating committee of the society, consisting of H. W. Whitten, chairman; Charles F. Newport, Chicago; F. R. Still, Detroit; Joseph Graham, New York; and George Mehring, Chicago, has nominated the following as officers of the society for 1913:

FOR PRESIDENT

John F. Hale, Camden, N. J.

FOR VICE-PRESIDENTS

Edmund F. Capron, Chicago.
Albert B. Franklin, Boston.

FOR TREASURER

James A. Donnelly, New York.

FOR BOARD OF GOVERNORS

Frank T. Chapman, New York.
Ralph A. Collamore, Detroit, Mich.
Dwight D. Kimball, New York.
William W. Macon, New York.
James M. Stannard, Chicago, Ill.
Theodore Weinshank, Indianapolis, Ind.

Illinois Chapter.

Ventilation of small theatres came in for a lengthy discussion at the November meeting of the Illinois Chapter, which was held at Vogelsang's Restaurant, Chicago, Nov. 11. The committee in charge for the meeting was composed of E. L. Hogan, Cuthbert Schaefer and J. E. Truitt and the principal speakers were Dr. E. Vernon Hill, chief inspector of the Chicago Bureau of Ventilation, and Charles B. Ball, Chief Health Inspector of Chicago.

In presenting the subject, Mr. Hogan stated that there were over 500 small theatres in Chicago, having 300 seats or less. Figuring that these theatres are filled three times a day, it could be seen that the subjects affected 500,000 people in Chicago alone.

Dr. Hill spoke of the difficulty of securing proper ventilation of small theatres due to the fact that no consideration as to ventilation is taken by the owners in the construction of such buildings and that their compliance with the law is on the basis of installing the cheapest and simplest design that will bring them within the limits prescribed. He stated that there were over 9,000 deaths in Chicago last year due to impure air and that the percentage of deaths from this cause has risen steadily from 14 per cent. thirty years ago to 28 per cent. ten years ago.

Regarding the enforcement of the ventilation provisions of the Chicago code, Dr. Hill stated that it is not possible to have the licenses of theatres cancelled as a result of non-compliance with the law, but that it was necessary to bring civil suit against the owners.

Plans of two theatres, with suggestions for their ventilation, were distributed by Mr. Truitt, which resulted in an interesting discussion, in which the advantage of locating the air inlets beneath the seats was brought out.

John F. Hale, who was present as a guest, being now affiliated with the New York Chapter, made the interesting announcement that the society was promoting a plan for the inauguration of a national commission on ventilation, the funds for which might be forthcoming from an important philanthropic organization.

New York Chapter.

The proposed new Ohio Building Code, containing, among other things, provisions for the ventilation of public and other buildings, was up for discussion at the November meeting of the New York Chapter. President Frank G. McCann was in the chair. D. D. Kimball gave a synopsis of the proposed code, showing how the provisions would work a hardship on the designing engineer on account of the many stringent requirements, covering almost every feature of the design, including the sizes of air flues and registers. The code is intended to apply to theatres and assembly halls, churches, schools, asylums, hospitals and homes, hotels and tenement houses, club and lodge buildings and workshops, factories and mercantile establishments. The different systems permitted are specified as standard ventilating stoves, gravity furnace systems, mechanical furnace systems, direct heating, gravity indirect steam or hot water, mechanical indirect steam or hot water, split steam or hot water and mechanical ventilation systems.

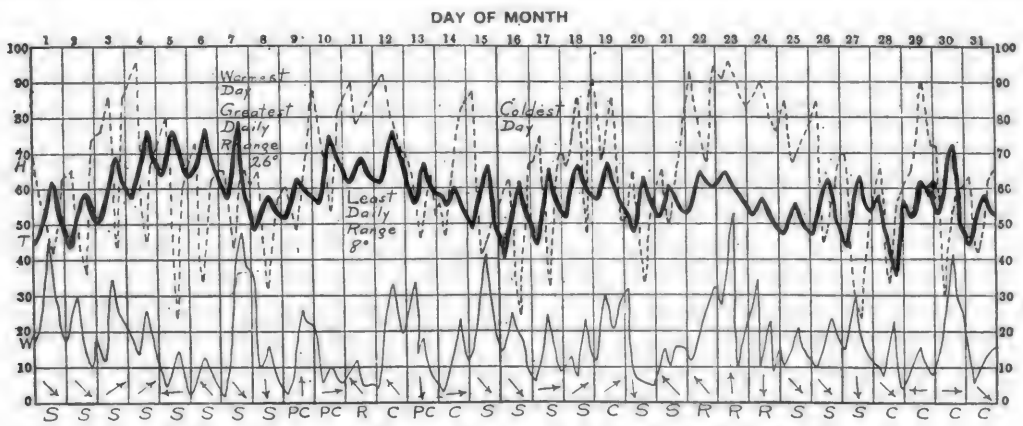
The chapter will refer the proposed code to some of the society's Ohio members with a view of securing the desired modifications. The code was drawn up by Fred W. Elliott, consulting architect to the Ohio Building Code Commission, Columbus, O.

The election of the following new members was announced: Members, F. J. Lennox and

(*Continued on page* 42.)

THE WEATHER FOR OCTOBER, 1912

	New York.	Boston.	Pitts-burg	Chicago.	St. Louis.
Highest temperature, degrees F.....	79	86	83	84	86
Date of highest temperature.....	7	7	11	6	26
Lowest temperature, degrees F.....	40	36	34	38	37
Date of lowest temperature.....	16	16	27	23	23
Greatest daily range, degrees F.....	26	31	29	23	28
Date of greatest daily range	7	17	6	6	21
Least daily range, degrees F.....	8	4	3	3	12
Date of least daily range.....	11	11	24	10	18
Mean temp. for month, degrees F.....	58.5	57	56	55.8	61
Normal mean temp. for month, degrees F....	55.6	52	54.9	53.2	58.4
Total rainfall, inches.....	4.32	1.	2.68	3.52	2.61
Total snowfall, inches.....	0.	0.	0.	0.	0.
Normal precipitation, this month, inches.....	3.71	3.86	2.36	2.55	2.41
Total wind movement, miles.....	11,512	7,102	7,278	9,446	6,870
Average hourly wind velocity, miles.....	15.5	9.5	9.4	12.7	9.2
Prevailing direction of wind.....	N.W.	West	N.W.	S.W.	S.E.
Number of clear days.....	11	17	12	17	17
Number of partly cloudy days.....	10	5	10	6	7
Number of cloudy days.....	10	9	9	8	7
Number of days on which rain fell.....	7	7	8	14	7
Number of days on which snow fell.....	..	..	..	..	..
Snow on ground at end of month, inches.....	..	..	..	..	..


DAY OF MONTH
Warmest Day
Greatest Daily Range 26°
Coldest Day
Least Daily Range 8°
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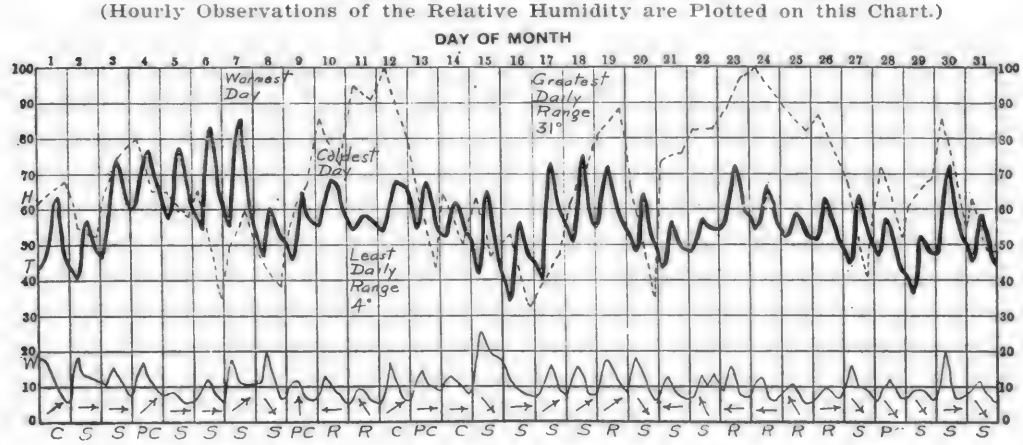
RECORD OF THE WEATHER IN NEW YORK FOR OCTOBER, 1912.
(Hourly Observations of the Relative Humidity are Plotted on this Chart.)


DAY OF MONTH
Warmest Day
Coldest Day
Greatest Daily Range 31°
Least Daily Range 4°
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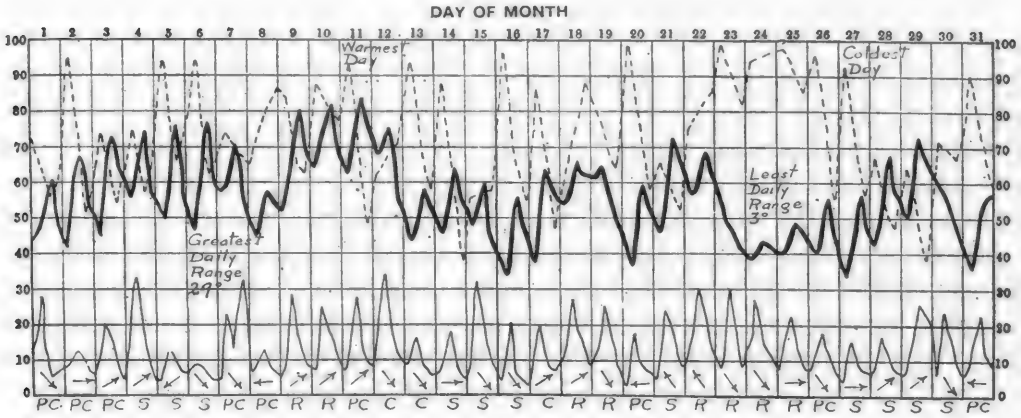
RECORD OF THE WEATHER IN BOSTON FOR OCTOBER, 1912.


DAY OF MONTH
Warmest Day
Coldest Day
Least Daily Range 3°
Greatest Daily Range 29°
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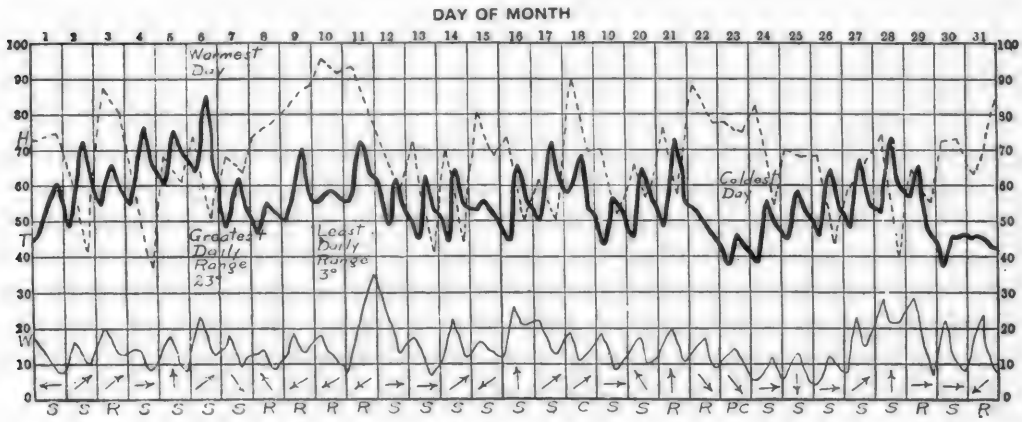
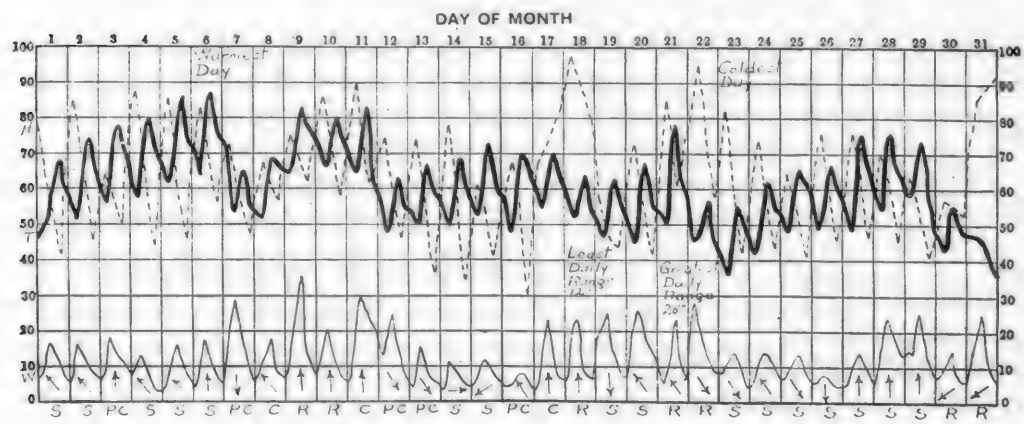
RECORD OF THE WEATHER IN PITTSBURG FOR OCTOBER, 1912.



RECORD OF THE WEATHER IN CHICAGO FOR OCTOBER, 1912.



RECORD OF THE WEATHER IN ST. LOUIS FOR OCTOBER, 1912.

Plotted from records especially compiled for "The Heating and Ventilating Magazine," by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

American Society of Heating and Ventilating Engineers.

(*Continued from page* 39.)

R. C. Taggart; associate members, A. A. Du Mond, C. F. Chase and W. G. W Turno.

The matter of incorporating the chapter will come up for final action at the December meeting.

Committee on Annual Meeting.

The board of governors of the New York Chapter has appointed the following committee to assist the officers of the society in connection with the forthcoming annual meeting, January 21-23, 1913: Homer Addams, Chairman; Frank T. Chapman, Frank K. Chew, P. A. Hoffman, R. B. Hunt, C. E. Scott, R. C. Taggart, W. S. Timmis and A. S. Armagnac.

Annual Meeting of Massachusetts Chapter

The adjourned annual meeting of the Massachusetts Chapter was held in Boston, November 19. The following officers were elected: President, Frank Irving Cooper; vice-president, H. W. Whitten; secretary, J. W. H. Myrick; treasurer, William T. Smallman; board of governors, Capt. Joseph A. Moore, D. S. Boyden and William G. Snow. William N. McKenna was elected to membership.

The December meeting will be held at the Boston Press Club, December 10, dinner being served at 5:30. The subject for discussion is "Separation of Heating and Ventilating Contracts from the Geenral or Other Contracts."

American Society of Mechanical Engineers.

Ten sessions, with papers grouped to form symposiums upon various subjects, were included in the programme for the annual meeting of The American Society of Mechanical Engineers, held in New York, December 3-6, 1912. Among the papers were the following: "Measurement of Air in Fan Work," by Charles H. Treat; "Dimensions of Boiler Chimneys for Crude Oil," by C. R. Weymouth, and "The Centrifugal Blower for High Pressures," by Thomas R. Weymouth.

New officers were elected for the ensuing year as follows: President, W. F. M. Goss, Urbana, Ill.; vice-presidents, James Hartness, Springfield, Vt., I. E. Moultrop, Boston, and H. G. Stott, New York; managers: W. B. Jackson, Chicago; H. M. Leland, Detroit, and Alfred Noble, New York; treasurer, Wm. H. Wiley, New York.

Plans are going forward rapidly for the meeting of The American Society of Mechanical Engineers with the Verein deutscher Ingenieure in Germany next June. The date of departure will be June 11 from New York. After attending the technical sessions of the German society in Leipzig, June 23 and 24, the party will leave for a tour of industrial Germany, visiting the principal cities. It is expected that the Krupp gun works will be thrown open to the visiting party. The final meeting will be held in Munich, July 7.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

CENTRAL HEATING STATIONS.

Wilkes-Barre's District Heating System. Donald M. Belcher. Illustrates and describes the construction and reported cost of installing heat-insulated mains under ground. 2500 w. Eng. Rec—Sept. 14, 1912. 20c.

COMBINED ELECTRIC AND STEAM HEATING PLANTS.

Combined Central and Heating Plants. Edwin D. Dreyfus. El. Jl. Aug., 1912. 15 figs. 3500 w. Discusses new developments in prime movers, making it possible to effect material improvement in the efficiency of consolidated electric and steam heating plants. 40 cents.

HOT WATER HEATING.

The Hot Water Heating in Highland Park Greenhouse. Harold L. Alt. Illustrated description of an installation in a city building at Rochester, N. Y. 1000 w. Dom. Engng—Sept. 21, 1912. 20c.

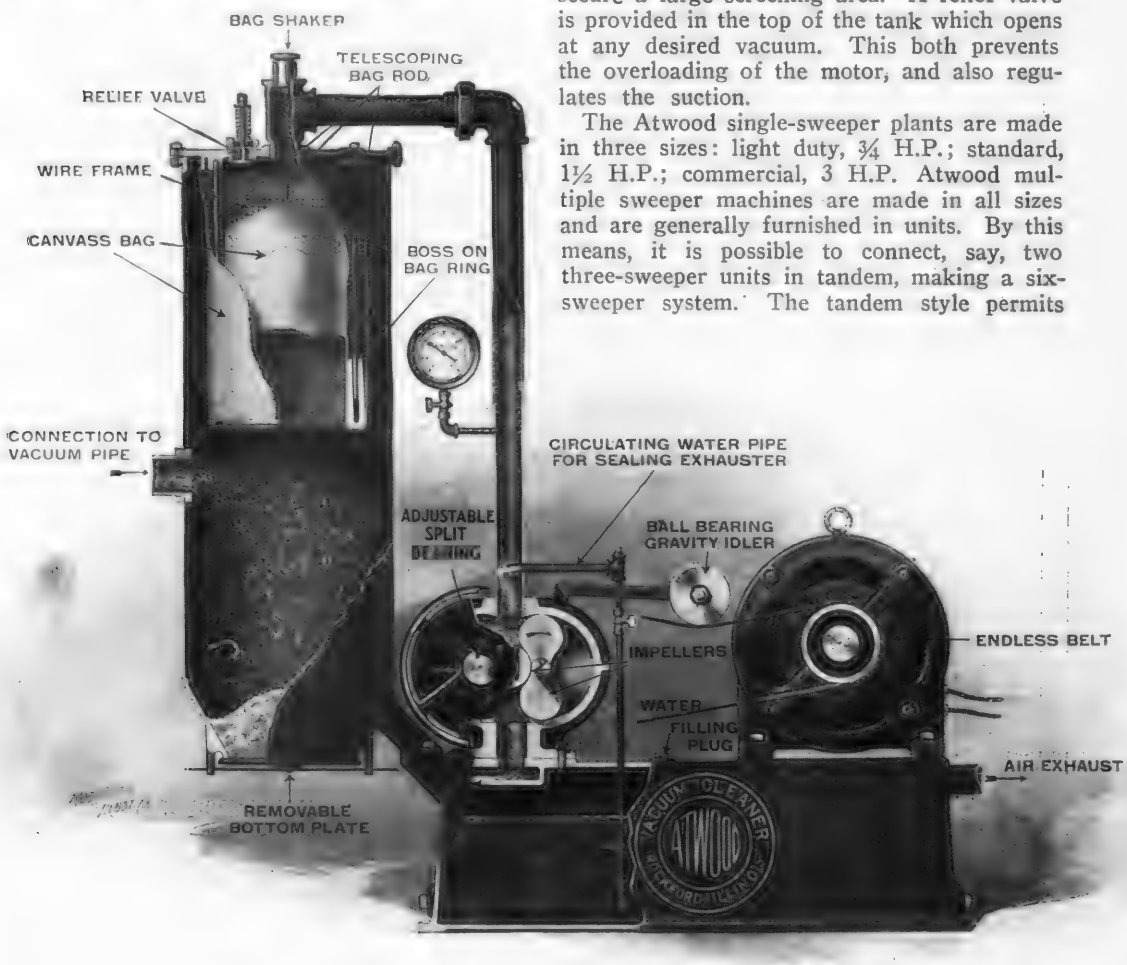
Heating a Large Auditorium With Gas Stoves.

A unique gas heating plant for the Terminal Auditorium in Toledo has been installed by the Toledo Industrial Exposition Co., lessees of the building. It consists of 104 gas stoves, with overhead, radiating vents. These serve to heat the twin auditoriums and adjoining lobbies, offices, etc., representing 4,500,000 cu. ft. of space. The stoves, which use artificial gas, are placed along the walls of the building and are ventilated by pipes running parallel with the roof. One of the principal reasons for the adoption of this system is that the building is to be heated intermittently. Also, for parts of the time, one or more sections of the building require heat when the main auditorium is not in use and on this account it was figured that the first saving in the cost of installation over a steam or hot water plant was sufficient to justify the use of the gas heating system. The system, as installed, cost approximately $2,000.

Modern Vacuum Cleaning Apparatus

1—Atwood Vacuum Cleaner.

Atwood vacuum cleaners are made for both stationary and portable use. In the stationary plant, the dirt is gathered in an air-tight receptacle in the basement whence the air and disease germs are discharged out-of-doors through a vent pipe or chimney. The action



THE ATWOOD STATIONARY VACUUM CLEANING MACHINE.

of the Atwood exhauster is positive, enabling it to be operated without internal friction or wear. The efficiency of the system is further increased by sealing the exhauster. As shown in the illustration, a quantity of water is contained in the base which is drawn up, entering the exhauster in a fine stream with the air. This water is recirculated, the large storage capacity preventing rapid evaporation.

The Atwood exhauster is of the two-shaft rotary type. Each shaft carries an impeller similar to a two-toothed gear. These impellers turn in opposite directions and operate with a slight clearance on all sides.

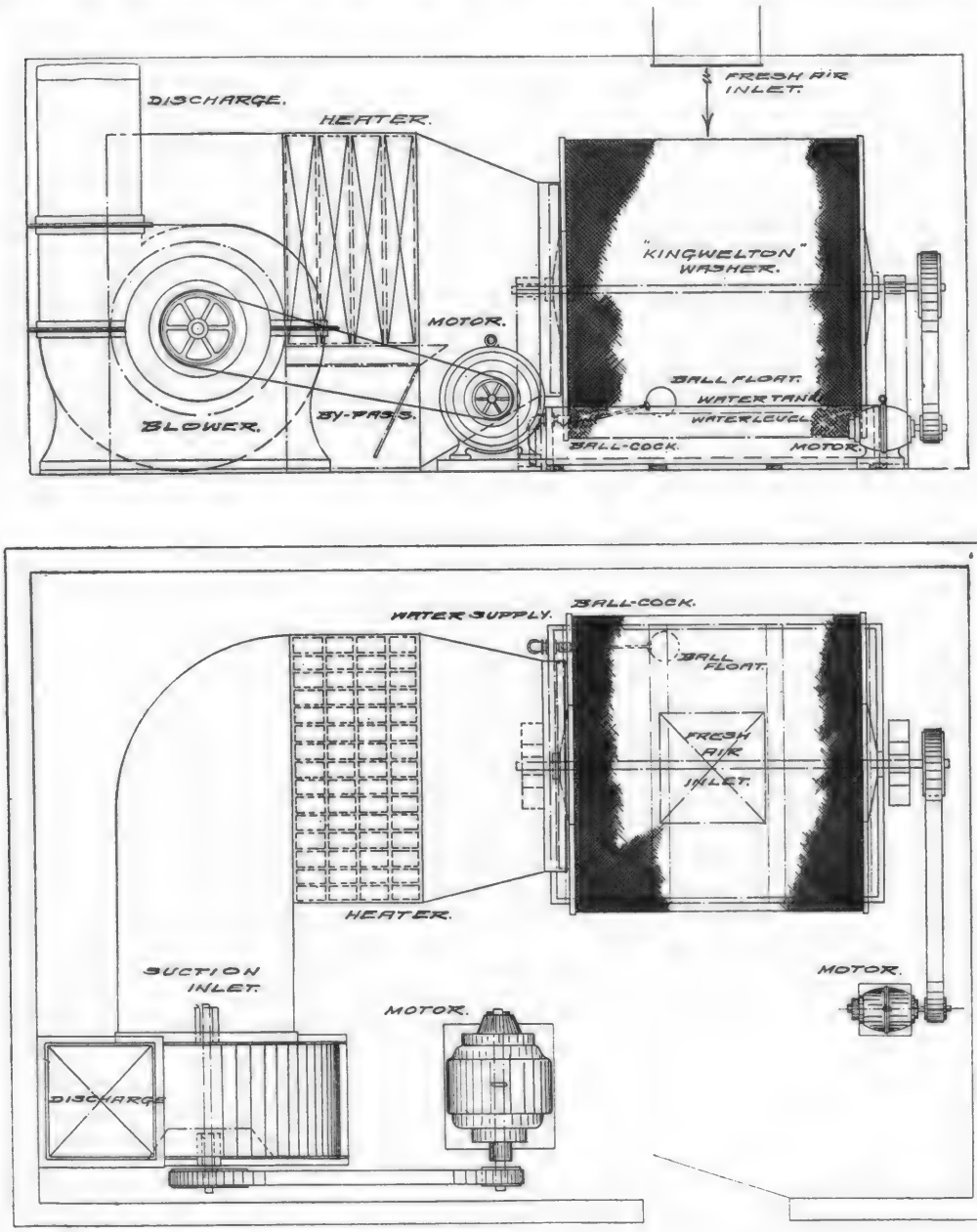
For the dirt separation, the bag is fastened to the top plate, and extends down around the bag ring at the end of the bag rods and then up in the middle where it is fastened to the chain for shaking. This is done to secure a large screening area. A relief valve is provided in the top of the tank which opens at any desired vacuum. This both prevents the overloading of the motor, and also regulates the suction.

The Atwood single-sweeper plants are made in three sizes: light duty, ¾ H.P.; standard, 1½ H.P.; commercial, 3 H.P. Atwood multiple sweeper machines are made in all sizes and are generally furnished in units. By this means, it is possible to connect, say, two three-sweeper units in tandem, making a six-sweeper system. The tandem style permits the use of both units together, or, if desired, either independent of the other. These machines are furnished with any of four different types of separation as follows: direct discharge to sewer (one tank); bag screening tank (one tank); gravity tank for heavy dirt and bag tank to screen light dirt (two tanks); and gravity tank for heavy dirt and wet tank to screen light dirt (two tanks).

The general distributor of the Atwood vacuum cleaners is the Kellogg-Mackay Co., Chicago, Ill.

The Kingwelton Rotary Air Washer.

Something new in the way of an air washer has been perfected by the Wells & Newton Co., New York, engineers and contractors in mechanical equipment of buildings, and is shown in the accompanying illustrations. The principal feature of the Kingwelton rotary air washer is a revolving drum, encased with an imported fabric of suitable mesh and weave. The drum revolves through a water bath at any desired speed. The covering of the drum is of special linen burlap, coarsely woven from a hard fiber, the mesh being seven strands to the inch. The openings are accordingly ⅛-in. square. In operation, as the burlap passes through the water bath it becomes covered with a thin veil of water through which the air passes, the impurities and other particles being deposited on the outer surface of the fiber. These are washed off as the drum revolves through the water chamber.



INSTALLATION OF KINGWELTON AIR WASHER IN THE FLATIRON BUILDING, NEW YORK.

The washer is operated by a direct-connected

motor which drives the gear wheels on the shaft of the cylinder.

Eliminators may be used or not with this type of air washer. As to controlling the humidity of the air, the manufacturers state that this can be accomplished by equipping the water chamber with steam coils and thus heating the water as required. Further regulation is secured by varying the speed of the drum. Ordinarily, however, the drum revolves at the rate of 1 R. P. M.

The practice of heating the water to secure humidifying effects may be reversed when it is desired to cool the air by using cold water in the water chamber.

The accompanying view shows a typical installation of the Kingwelton air washer in the Flatiron Building, New York. In another typical installation in the Union Railroad Station, Pittsburgh, Pa., the dimensions of the washer are: diameter, 7 ft.; length, 10 ft. With these dimensions, the washer has a capacity of passing 22,000 cu. ft. of air per minute. In a report of the operation of this washer, it is stated that 99% of the impurities, consisting largely of carbon, were eliminated and deposited in the water chamber, the accumulation being 1½-in. in 24 hours.

The Kingwelton air washer is the invention of Morris S. King, general manager for the Wells & Newton Co., patent on which is now pending.

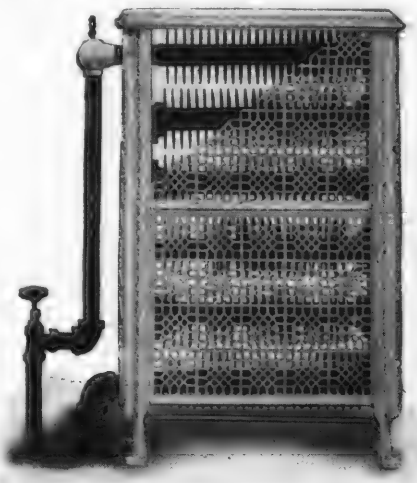
New Form of Radiator.

A radical departure from the usual form of radiator for hot-water heating has been placed on the market under the name of the Vici radiator. It is designed for use in connection with the Vici system of heating, in which the hot water is confined to wrought iron pipes. The Vici radiators are composed of pipes on which are fitted disks made of pressed steel. These disks are thin and solid and they contain no water. From their contact with the hot pipes, they are designed to gather the heat generated by the hot water as it circulates through these pipes and thus warm the air surrounding them.

In operating this system the pipes only are filled with water, so that it is estimated that only one-twentieth as much water is needed as in the ordinary hot-water heating system. As the water in the boiler is warmed, it ascends in the pipes and after giving out its heat to the pressed steel disks in the radiators, the water returns as in an ordinary system to the boiler.

One of the features emphasized in connection with this system is the rapidity with which the radiators heat. This is also an advantage in case the weather unexpectedly moderates when the radiators will as quickly cool.

In appearance, the Vici radiators are light, occupying less space than cast-iron radiators of the same capacity. The comparative weights of the two types are 140 lbs. for the Vici as against 520 lbs. for the cast-iron type. The Vici radiators are made by the Rhodes Bros. Co., 928-930 North Eighth St., Philadelphia, Pa.



VICI RADIATOR WITH SECTION OF GRILL CUT AWAY TO SHOW DISKS.

The Detroit Multi-Port Vapor Valve.

A valve that differs from the ordinary type of fractional valve, in that it is not necessary to choose a different size for each radiator or figure out any allowance for loss of steam pressure due to friction or condensation, has lately been brought out by the American Radiator Co., Chicago, as briefly described in last month's issue. One standard size valve works for all radiators, it being possible to accurately and delicately adjust the valve to pass the proper amount of steam to supply any given amount of radiation at any distance from the boiler.

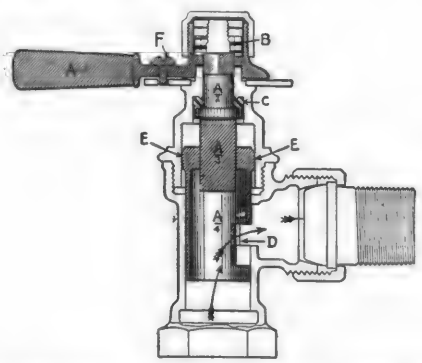
The principle of the double adjustment and the fractional regulation are represented in the illustration by the parts lettered A-1, A-2, A-3, A-4. When the handle A-1 is moved all these parts marked A move with it as a unit, so that when the set screw is in place, and the handle A-1 is moved through the arc of the fractional adjustment, the opening D in the shell A-4 is moved laterally across the similar opening in the body of the valve, thus opening or closing the valve, or providing any intermediate adjustment desired.

The double adjustment feature is provided by the thread on the shell and the body of the valve at E, the lower portion A-3 on the

piece A-2—A-3 is square, and is not connected to the shell A-4, but is inserted in a similar shaped opening in the top of the shell. after the manner of a key-wrench.

When the set screw F is removed, and the handle A-1 rotated completely around, the shell A-4 is thus able to slip easily up or down over the stem A-3, and the shell is lowered or raised, as the case may be, on the threads E.

In this manner, with a vertical movement of 1/32-in. to each complete revolution of the valve handle, any desired portion of the opening D in the valve shell can be brought opposite the similar opening in the body of the valve. When the desired maximum opening is thus obtained the set screw F is returned to its place, and the fractional adjustment of the area thus permanently established is again obtained by the lateral movement of the shell when the handle A-1 is operated through the arc provided for the fractional adjustment.



INTERIOR ARRANGEMENT OF DETROIT MULTI-PORT VAPOR VALVE.

For example, in the accompanying illustration it will be seen that the vertical adjustment of the shell, as there illustrated, is such that just one-half of the opening in the shell laps the opening in the body of the valve when the fractional adjustment is wide open at "hot," giving a miximum area for the port of 0.1935 sq. in. As the pointer is moved from "hot" to "cold" by the operation of the handle A-1, this port will be gradually reduced to O by the lateral movement of the shell, in the same manner that an quick-opening valve operates, and an intermediate fractional adjustment that may be desired is thus provided.

Trade Literature.

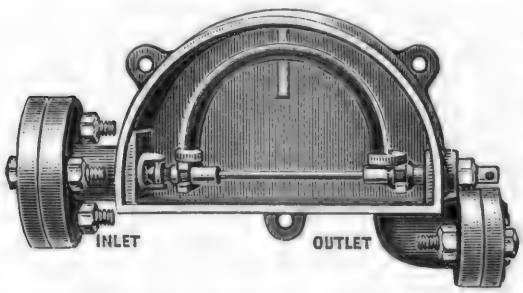
COCHRANE METERING HEATER, equipped with the Cochrane steam-stack and cut-out valve, is featured in new circular matter being sent out by the Harrison Safety Boiler Works, 3819 No. 17th St., Philadelphia, Pa. It is built to combine the functions of a boiler feed water heater, an oil separator and a meter. With this apparatus it is possible to tell the amount of steam being produced per pound of fuel, providing a record is kept of the coal used. The measuring organ of the meter is a V-notch weir. The recording instrument gives a record of the water consumption throughout the day, also the total for any period.

NATIONAL PIPE is the subject of a special article in the N. T. C. Bulletin for September, 1912, published by the National Tube Co., Pittsburg, Pa., in which the "Spellerized" process is described. This is a method of treating metal, which consists in subjecting the heated bloom to the action of rolls having regularly-shaped projections on their working surface, then subjecting the bloom, while still hot, to the action of smooth faced rolls and repeating the operation, whereby the surface of the metal is worked so as to produce a uniformly dense texture better adapted to resist corrosion, especially in the form of pitting. In connection with this process, which is now being applied principally to pipe 4-in. and under, the company is rolling, at regular intervals, on every length of welded pipe, the name "National" for identification purposes.

"TYCOS"-ROCHESTER, for September-October, 1912, the interesting periodical published by the Taylor Instrument Companies, Rochester, N. Y., contains, in addition to an illustrated report of the company's 1912 sales convention, the original questions and correct answers in a prize competition relating to the use of the company's products, including barometers, barographs and other weather instruments. The questions cover such topics as the measurement of the height of mountains, barometer corrections necessary for points above sea level, which end of a compass points north, etc.

A GUIDE HOW TO CHOOSE THE VACUUM TRAP that is used in heating work, points to look for and points to avoid, is the title of a new pamphlet published by the C. A. Dunham Co., Marshalltown, Ia. The pamphlet, which is handsomely printed and illustrated, describes a conversation taking place between an architect, an owner, and a salesman, in which the various points, pro and con, on a radiator trap, are brought out. Although presented in a way that will be clear to a layman, the discussion will be found most interesting reading by all who are engaged in vacuum steam heating work. The reader will recognize bits of the conversation as similar to those frequently heard where vacuum heating is being discussed. In this case, however, the various points are answered as fully as they are usually presented.

HEINTZ STEAM TRAP, sold in this country by H. A. Rogers & Co., 19 John St., New York, is featured in new circular matter giving detailed description of the trap's operation, as well as price lists for capacities ranging from 200 to 70,000 ft. of 1-in. pipe. The unique feature of this trap is its method of operation through the expanding and contracting of a tube spring, caused by an internal fluid. The valve will close in this manner, it is stated, against a pressure of 200 lbs.



HEINTZ STEAM TRAP WITH COVER REMOVED.

PECK AUTOMATIC DRAINAGE VALVE, check valve type, for draining air and water from steam heating apparatus, is something new in the way of a steam trap, described in a newly-issued circular. It is intended to be attached to the discharge end of the radiator and serves as a continuous draining device for both air and water. The governing element is the diameter of the circular passage through the check valve chamber, this being made to suit the volume of discharge and pressure used. Because of the large water draining capacity of a small hole, and the small weight of steam which will pass through the same hole, the degree of pressure can be varied to any needful extent. It is said to be well suited to either high or low pressure work. The circular contains illustrations, in color, of the valve, which is made by Cassius C. Peck, 721-723 Ellwanger & Barry Building, Rochester, N. Y.

WHAT WE MAKE, is the title of a compact 48-page book issued by the Green Fuel Economizer Company, Matteawan, N. Y., describing fuel economizers, both standard and special, coverings for fuel economizers, mechanical draft outfits, heating, ventilating and drying outfits, hot blast heaters, steel plate fans, motor and engine-driven fans, cast-iron volume blowers; slow-speed and standard-speed planing mill exhausters, fan and cone wheels, wool wheels, ventilator wheels, propeller fans, vertical and horizontal engines and mechanical draft dampers.

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THE CONTINENTAL and COMMERCIAL NATIONAL BANK BUILDING CHICAGO
Hanley Casey Co., Heating and Ventilating Contractors, Chicago

D. H. BURNHAM & CO., Architects, Chicago, through their Board of Consulting Engineers and the Investigating Committee appointed by the Bank, adopted the MONASH NOISELESS SYSTEM of VACUUM HEATING for the CONTINENTAL & COMMERCIAL NATIONAL BANK BUILDING, which covers an entire city block, the largest building of its type under one roof in the world.

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Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

TRADE AND MISCELLANEOUS NOTES

Coming Events.

THIRD TUESDAY IN EACH MONTH—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, at the Engineering Societies Building, 29 West 39th St., New York.

SECOND WEDNESDAY IN EACH MONTH—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, at Vogelsang's Restaurant, Chicago.

SECOND TUESDAY IN DECEMBER—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers at the Boston Press Club.

DECEMBER 27-28, 1912—Sixth annual meeting of the American Association for Labor Legislation in Boston, Mass.

JANUARY 21, 22, 23, 1913—Annual meeting of The American Society of Heating and Ventilating Engineers, in New York. Headquarters at the Engineering Societies Buildings, 29 West 39th St.

Miscellaneous Notes.

ELKHART, IND.—The proposal to install a $300,000 central heating plant at Elkhart is dependent upon the use of the exhaust steam from the engines at the water pumping station. The attitude of the principal stockholders of the Elkhart Water Co. on the proposition has not as yet been declared. Among the capitalists interested is H. E. Bucklen, of Elkhart.

ERIE, PA.—Permission has been given the Home Heating Company by the common select council to tear up the desired number of paved streets for the purpose of installing additions to the company's heating system.

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

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Labor Savers for Duct Work

Two piece galvanized elbows having a smooth interior finish and full area from end to end. Can be trimmed to any angle for offsets or special fittings.

Used for Factories, Wood-working Plants, Dust Conveyors, Concrete Spouting, Heating and Ventilating Systems.

McCreery Engineering Co., DETROIT MICH.

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LOUISVILLE, KY.—Chancery Judge Quarles has heard arguments in the suit of Z. T. Underwood, as a citizen, against the Kentucky Heating Co., to recover for the city of Louisville, $25,000 for each of the two years since the alleged expiration of the defendant's franchise. The suit, which was filed two years ago, also seeks to enjoin further use of the streets until a new franchise is obtained. The heating company contends that its franchise never had expired and that it was operating under the franchise of the Kentucky Fuel Gas Co., which was chartered in 1886 and given authority to do business for 50 years.

OLIVET, MICH.—In order to expedite the work on the new $25,000 central heating plant, college students are being employed in the afternoons and on Saturdays to dig trenches for the conduits.

MADISON, WIS.—Buildings on the south side of Milwaukee Street bridge, which formerly were heated by central hot water heating system controlled by the Janesville Electric Co., are to be heated this winter by a central vacuum steam system, now being installed by McVicar Bros., for George G. Sutherland. The piping and radiators are being adapted for the use of steam, and two boilers, with a capacity of 16,000 sq. ft. of radiation, have been installed in the basement of the Howard dry goods store.

MARYVILLE, MO.—Work has commenced on the new central steam heating plant at that place. The steam will be supplied from the electric light plant. W. P. Currie of Lockport, N. Y., is the engineer in charge.

MILWAUKEE, WIS.—A system of street car heating, similar to that in use in Cleveland and Detroit, will be installed in the street cars of Milwaukee, according to Vice-President R. B. Stearns, at a cost of $60,000. The company has contracted for 180 heaters, which will be placed in the center of the cars, equipped with blowers for circulating the air. Cool air will be drawn from the outside and forced through galvanized iron pipes extending the length of the car, with outlets under each seat. The stoves will be supplied with coal by the magazine system, working automatically.

MCCOMB, O.—The plant of the Licherson Mfg. Co., organized recently by residents of Findlay and McComb for the manufacture of a new type of heating apparatus invented by J. Frank Hickerson, of McComb, will be located at McComb, instead of at Findlay, as was at first proposed. The plant will be built on the W. E. Dick property, opposite the union sta-

Nonpareil Coverings are made of diatomaceous earth, combined with asbestos fibre. Diatomaceous earth is made up of the skeletons of minute plants, billions to the cubic inch, each filled with air. It is practically pure silica. As air entrapped in minute particles is the most efficient insulating medium known, it can readily be seen why Nonpareil Covering is the ideal high pressure and superheat covering.

Another Efficiency Test That You Can Make

Here is another test that you can make that proves both the efficiency of Nonpareil Covering as a non-conductor and its proof against high temperatures. Heat one side of a piece of Nonpareil Covering with a blowpipe until it is white hot. You can still place your hand against the other side without discomfort. Then when it is at white heat, plunge it for a moment into cold water. A few hair-line cracks will develop but otherwise the surface will remain smooth, uninjured and hard. Try this experiment with any other kind of covering and draw your own conclusions from the results.

NONPAREIL High Pressure COVERING FOR Steam Lines and Boilers

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Branch Offices in the Large Cities

tion. The company will make a compressed air heating system for dwellings and a portable heater for heating water in outdoor tanks and also for cooking stock foods.

CHICAGO, ILL.—Fresh charges of bribery and the reopening of the famous heating franchise graft cases against Mayor Thomas E. Knotts, aldermen and former city officials of Gary, Ind., are promised through the confession of Harry Moose, former city clerk and principal witness for the state, whose disappearance last spring brought the bribery cases to a halt. The former city clerk is in jail at Crown Point, and is reported critically ill of consumption. The cases were started about a year ago by Thomas B. Dean of Louisville, Ky., who exhibited more than $16,000 in marked money which, he asserted, constituted bribes he had paid for a heating franchise in Gary.

OGDEN, UTAH.—Two 150 H. P. boilers, to operate at 160 lbs. pressure, will be included in the heating equipment for the new union passenger station at Ogden. The plant, when completed, will furnish steam for heating the subway, station buildings and cars parked in the yards. The stack will be of steel tubing 5 ft. in diameter and 100 ft. high. A temporary heating plant will be used, as the new equipment will not be ready for use until late in the winter.

F. D. CROCKER, general superintendent of the Milwaukee Central Heating Co., Milwaukee, has accepted a position with the H. M. Byllesby Co., of Chicago, and will be connected with the Consumers' Power Co., of St. Paul, which is one of the Byllesby Company's properties.

FOND DU LAC, WIS.—A new heating plant will be installed at the county jail as soon as the plans are ready, according to the decision of the building committee board. M. Commo is chairman of the committee.

TRENTON, N. J.—The New Jersey and Pennsylvania Traction Co. is replacing the hot water heaters on its cars with hot air systems, with stoves.

YORK CITY, PA.—Pipes for the extension of the South George Street line of the York Steam Heating Co. are being laid from Mason Alley to College Avenue. The city council recently passed an ordinance for the extension of the line. It is reported that the new federal building is to be heated from the heating company's mains.

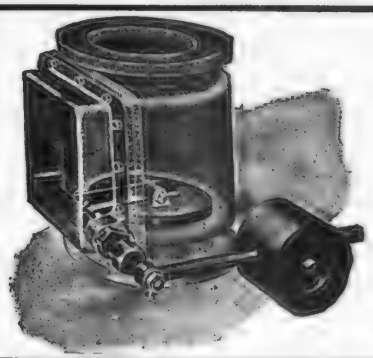
KEEWATWIN, MINN.—A steam heating system, to cost $2,800, is being built at Keewatwin to heat a number of the business buildings of that place. The mains will extend two blocks.

ALGONIA, IA.—The heating plant at Highland Park College was destroyed by fire November 2. The estimated loss is $10,000.

GALESBURG, ILL.—The city council granted a franchise November 11 to A. L. and L. Weinberg for the operation of a steam and hot water central heating plant. The company now operating in Galesburg, it is stated, has reached the limit of its capacity. The rates to be charged, as outlined in the new franchise, are 30 cents per square foot of radiation per season. Free heat will be furnished to the fire department building. The life of the franchise is 20 years. Work will be commenced on the plant at once to take care of that part of the city extending from the post office to the Burlington station.

STATE SUPERINTENDENT C. G. SCHULTZ is making an investigation of the sanitary con-

BETTER THAN LEAD Dixon's Pipe Joint Compound is better and cheaper than red or white lead.
Doesn't "set" joints—goes farther.
JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.



EXCELSIOR STRAIGHTWAY BACK PRESSURE VALVE

A glance at the illustration will show its extreme simplicity and freedom from complicated parts. It has an area through the seat equal to that of the pipe.

As a back pressure valve it can be used in a vertical or horizontal position. It is especially desirable for exhaust steam heating. Also well adapted for use as a relief or free exhaust valve for condensing engines.

JENKINS BROS., New York, Boston, Philadelphia, Chicago

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ditions of the 1,200 school buildings in Minnesota, with a view to obtaining facts to be incorporated in a report which he expects to present to the State legislature in an effort to procure a more stringent law regarding the sanitary conditions, including those of heating and ventilation, of the public school buildings throughout the State. Tabulations are being made of the number of schools equipped with mechanical ventilation as well as those having methods for humidifying the air.

CHICAGO, ILL.—The clause often appearing in engineers' specifications requiring the contractor to guarantee the operation of heating and ventilating plants, has prompted the Master Steam Fitters' Association of Chicago to adopt a resolution to the effect that if the contractor is to guarantee the operation of the plant, he should be supplied with sufficient data to verify the engineer's estimates, etc. The text of the resolution, which has been sent out to architects and consulting engineers of Chicago, is as follows:

"Whereas, many diagrams and specifications showing radiator quantities and pipe sizes are not accompanied by sufficient data to enable the bidder to verify the architect's or consulting engineer's calculations at the time of bidding; therefore, be it

"Resolved, That members of this association will submit bids on plans and specifications which require them to guarantee radiation and pipe sizes shown to be sufficient for the specified results, only with the understanding that they shall, before entering into a contract with the owner, be furnished sufficient building plan data, such as window sizes, thickness and character of walls, ventilation conditions, etc., and be given time to verify and check the quantities and pipe sizes, at which time they will elect to execute the contract with or without extra charge as the case may be."

TRENTON, N. J.—The board of managers of the New Jersey State Hospital at Trenton has authorized the expenditure of $15,495 for a

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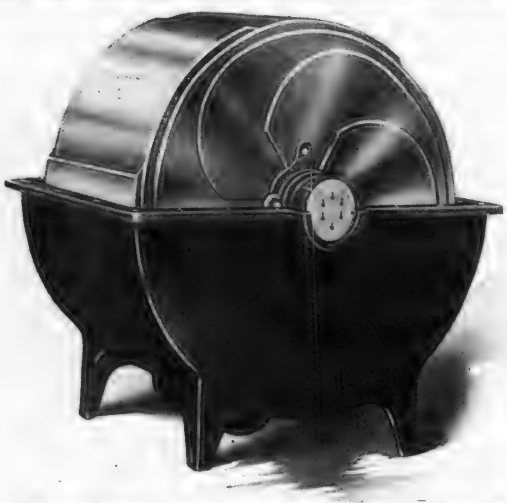

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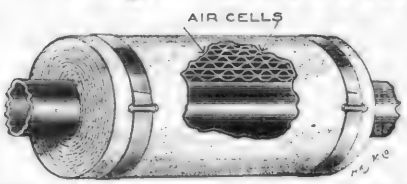

Is the most efficient covering for medium and low-pressure steam and hot-water heating systems, because it confines the largest amount of "dead air."

The air cells are *really* sealed rings of dead air encircling the pipe; whereas, in ordinary longitudinal air-cell coverings, they are cylinders or tubes running from end to end, allowing free circulation of air, which results in radiation of heat.

Due to its arch construction, J-M Asbestocel is stronger than any other covering—will not break or crush down under weight, and successfully withstands vibration and hard usage. Can be removed and replaced.

Being made of Asbestos, it is absolutely fire-proof.

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Philadelphia	Pittsburg	San Francisco
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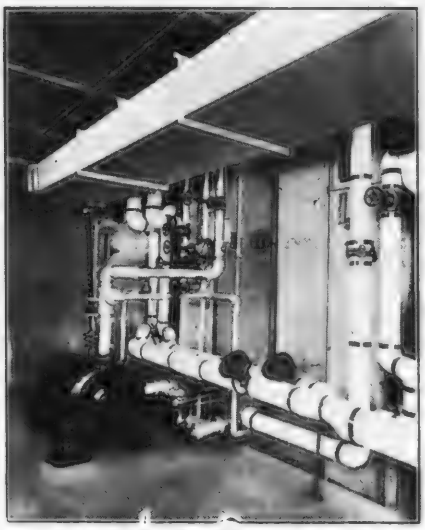
new heating and ventilating plant at the hospital.

HARRISBURG, PA.—An amendment to the mechanics' lien law of Pennsylvania will be offered to the State legislature at its next session. Under the operation of the present law those who supply materials used in building construction can file a lien on the building if payment is not made, even though, under some circumstances, the contractor may have received payment from the owner for the materials furnished by him. The matter has been brought to a head through the reported failure of contractors to make payment for their materials although they had received payment from the owner for their work. A proposed plan is to require the owner and contractor to give bonds for the payment of all materials before delivery. The Manufacturers' and Contractors' Club of Pittsburgh, has appointed a committee to work for an amendment to the present law.

PITTSBURGH, PA.—Three 300-ft. steel hull passenger boats for the newly-organized $3,000,000 Pittsburgh-New Orleans Navigation Co., will be built shortly, to operate between Pittsburgh and New Orleans. Each of the boats will have over 100 staterooms, all of which will be steam heated. The estimated cost of the heating and plumbing of each boat is $7,500. The establishment of this line is arousing much interest in the heating and plumbing trades in the Ohio and Mississippi valleys, as it will provide a convenient means of transportation for supplies by freight down the Ohio and Mississippi Rivers.

SAN FRANCISCO, CAL.—Major-General Leonard Wood has announced that San Francisco is to be made a brigade post and the headquarters of the army west of the Rocky Mountains and that new army barracks, and other structures, to cost $4,000,000, will be built in the near future.

CLEVELAND, O.—The Fairmount municipal heating plant has been placed in operation, and it is announced that the capacity of the plant has been contracted for at the rate established of 30 cents per 1,000 lbs. of steam. The city's contract with the Babcock & Wilcox Co., for furnishing two boilers for the plant was upheld by the circuit court, thus ending the mandamus proceedings brought by the D. Connelly Co. against city officials, in which the claim was made that the Connelly Company was the lowest bidder. Plans for doubling the capacity of the Fairmount plant are now being prepared by Engineer F. W. Ballard as a result of the additional requests for service that are being received. The system will be extended from East 105th Street to East 97th



WEBSTER AIR WASHER WITH HUMIDITY CONTROL
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"The Webster" Method of Humidity Control

is simple, practical and effective and may be applied to **WEBSTER STANDARD** and **TYPE "A" AIR WASHERS** at but little additional cost.

It requires simply the application of ordinary thermostatic devices with which all engineers and architects are familiar.

When considering an Air Washer specify **WEBSTER AIR WASHER** with **HUMIDITY CONTROL.** Specification forms furnished upon request.

The acknowledged leader in the field---a type of apparatus designed and built for each specific purpose:

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DUST REMOVAL **COOLING OF LIQUIDS**
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Street along Euclid Avenue. The cost of the extension is estimated at $25,000.

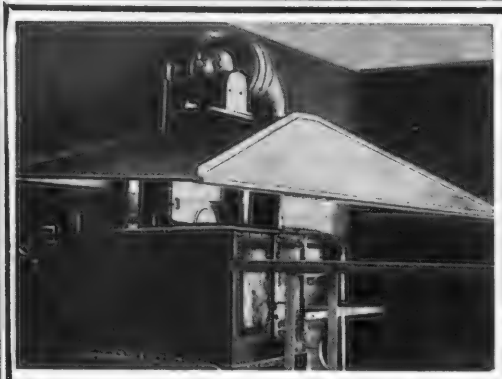
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS held its fifth annual meeting at Detroit, Mich., December 4-7, at the Hotel Cadillac.

VANCOUVER, B. C.—Following the report of the committee appointed by the Vancouver city council to investigate the smoke and sawdust nuisance caused by burning refuse from the various sawmills of the city, application has been made to the city by a company composed of some ten prominent mill owners for a franchise to sell steam heat and electric light and power. The company's intention is to use the sawdust and refuse for fuel by installing plants at the mills, the idea being to operate the different plants as sub-stations instead of establishing a central power plant. The engineer of the proposed company estimates the amount of sawdust and refuse burned annually by these mills as equivalent to 114,000 cords.

AMERICAN INSTITUTE OF ARCHITECTS announces that its Quarterly Bulletin will hereafter appear monthly under the title of The Journal of the American Institute of Architects. The first copy of The Journal will be published in time for distribution at the annual convention of the American Institute of Architects, in Washington, early in December. It is the purpose of the committee to make The Journal a dignified and serious technical journal. It will continue to be the official organ of the Institute.

AMERICAN ASSOCIATION FOR LABOR LEGISLATION announces that its forthcoming meeting in Boston, December 27-28, 1912, will be devoted to a general conference on labor laws. Topics to receive most attention in the discussions this year are the planks in the association's immediate legislative programme. "Factory Inspection and Labor Law Enforcement" is at the top of the list. The plan for Congressional legislation includes a new Federal employee's accident compensation law. Oscar S. Straus, former Secretary of Commerce, will lead the discussion. Charles Sumner Bird will speak on "An Employer's View of Factory Inspection," and Dr. John B. Andrews, of New York, the secretary of the association, will discuss "Occupational Diseases."

LABOR LAWS passed by Congress and by State legislatures during 1912 are described in an elaborate and authoritative bulletin just issued by the American Association for Labor Legislation, whose headquarters are in New York. Among the measures passed are two Massachusetts laws, one providing for minimum-wage boards and the other for the reorganization of factory inspection. In several States the number of factory inspectors is increased. New York State now has 125



Odors from cooking in the large kitchen of a private school being quickly carried away by a

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"The Original Fan of the Many Blade Plan"

When you specify and install "Sirocco," you banish future fan troubles for your client and enhance your own reputation.

A "Sirocco" Fan delivers more air at less cost for power than an ordinary fan twice the size.

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factory inspectors, a much larger number than is authorized in any other State.

WASHINGTON, D. C.—The United States Supreme Court, on November 18, upheld the decision of the Federal District Court of Maryland dissolving the so-called "bath-tub" trust, composed of manufacturers of enameled ware, as a combination in restraint of trade. The decision orders the dissolution of the selling arrangement under which the sixteen manufacturers were operating. The criminal suit against the members of the trust are scheduled to be retried in January.

Manufacturers' Notes.

AMERICAN RADIATOR CO., Chicago, has appointed F. S. Whitelaw as manager of its Canadian plant at Brantford, Ont. Mr. Whitelaw was manager of the company's boiler department at Chicago.

WESTERN HEAT REGULATION CO., San Francisco, Cal., has been reorganized, L. F. Halloran, one of the partners, being now the sole owner. The retiring partner, F. H. Bryant, has been appointed manager of the heating and ventilating department of the Machinery & Electric Co., of Los Angeles.

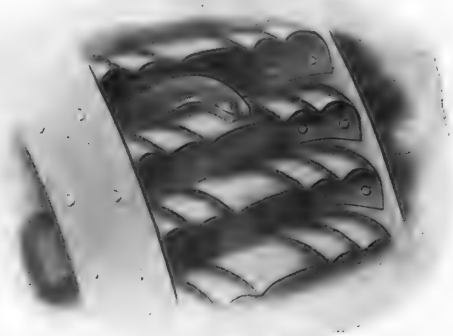
UNITED STATES RADIATOR CORPORATION, Detroit, Mich., will build an addition to its foundry at Edwardsville, Ind., to cost $20,000.

ANDREWS HEATING CO., Minneapolis, Minn., manufacturers of house heating boilers and supplies, has opened a branch office at Seattle, Wash., in the American Bank Building. The office is in charge of Lawrence K. Sowle, the company's manager for the Northwest territory.

H. MUELLER MFG. CO., Decatur, Ill., is now operating its new Canadian plant in full force. The plant occupies a site of 73 acres at Sarnia, Ont., opposite Port Huron, Mich. Oscar B. Mueller, president and general manager of the company, will reside at Sarnia and will divide his time between the Canadian plant and the company's New York office.

MINNEAPOLIS HEAT REGULATOR CO., Minneapolis, Minn., now has its new plant at Fourth Avenue and 28th Street, in complete operation, the office force having recently moved over to the new building.

C. & C. ELECTRIC & MFG. CO., New York, has purchased the good will, patents and other assets of the Garwood Electric Co., and will continue the manufacture of its line of electrical apparatus. The factory of the company at Garwood will continue in operation and the new company will complete all unfilled orders



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In the construction of the Sturtevant Multivane Fan every detail, from the rigid riveting of the blades and the strong construction of the spider to the accurate balancing of the fan wheel, has been made the subject of careful study and experiment. The experience of years of fan building has been used to develop a fan rigid and durable, as well as of high efficiency.

Durability is one of the principal features of the Sturtevant Multivane Fan.

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of the Garwood Electric Co. The officers of the new company are: President, Alexander Chandler; vice-president, Edward D. Floyd; treasurer, Charles L. Hyde. Board of directors, the officers and John A. Montgomery and B. W. Johnson. The new company starts with a capitalization of $250,000 cumulative preferred stock and $250,000 common stock. There is no bond issue or other lien on the property.

PITTSBURGH, PA.—The property of the Pressed Radiator Co. of America, at Pittsburgh, which was recently purchased at public auction by the Fidelity Title & Trust Co., of that city, has been transferred by the trust company to Frederick C. Perkins. It is expected that Mr. Perkins will organize a new company to operate the plant for the manufacture of sheet metal radiators. The plan is now being operated, 130 men being employed.

RICHMOND RADIATOR CO., New York, has been organized by interests which recently purchased the assets of the McCrum-Howell Co. for $870,000. The sale was effected early in November after the court had authorized the receivers to accept an offer of this amount. Prominent in the new company will be F. H. Moore, who has been identified with the reorganization plans and P. H. Seward, who was formerly identified with the McCrum-Howell Co. Announcement is also made of the incorporation of the Cameron-Schroth Co., Chicago, which will have the Western selling rights for the company's line of Richmond and Model boilers, Richmond radiators and vacuum cleaning machines.

CRANE & Co., Chicago, is arranging to establish its plant on a new site, comprising 160 acres which the company has recently purchased at South Kenzie and 39th Sts., near Archer Avenue, Chicago, about four miles southwest from its present plant. Building, it is stated, will commence in the Spring. When completed the plant will be one of the largest of its kind in the world. The company's general offices will also be removed to the new building at Michigan Avenue and Eldredge Court.

H. W. JOHNS-MANVILLE CO., New York, has opened a new branch warehouse in Atlanta, Ga., at 31½ South Broad St. The entire building of three floors and basement, with a total floor area of 10,000 sq. ft., will be used for the company's products, including boiler and pipe coverings, cements, packings, etc. The Atlanta office of the company is located in the same building.

HALSEY MFG. CO., Lynn, Mass., has appointed W. W. Hogle in charge of sales for

FIVE YEARS AHEAD

of the times. No spluttering air vents, automatic valves or pumps. More responsive than steam, every advantage of hot water and more. The

MOLINE SYSTEM OF HEATING

is simple, easy to install. Always satisfies—we guarantee that. Good contractors have no trouble getting more money for the "Moline System." Ask them.

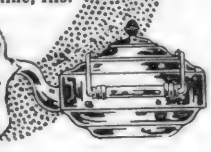
Free Book

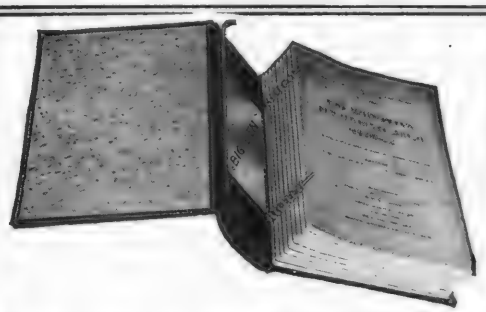
on heating for contractors It explains the device shown here at left and all the other features.

Moline Vacuum Vapor Heating Co.

Dept. E, Moline, Ills.

No more pressure than in your tea Kettle and just as simple





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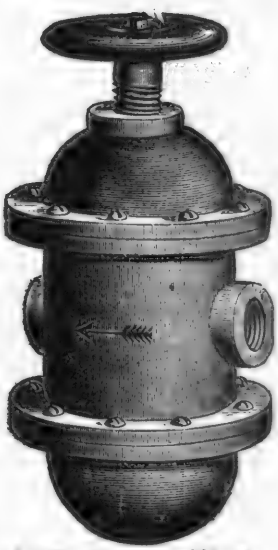
or are erecting a new installation, you want to know about the JOHNSON line of reducing valves. They were designed and are manufactured to pass the rigid inspection required of everything that carries the JOHNSON name.

For years we have been making valves for places where the ordinary kind would not do the work. Sticking, binding and wearing-out are unknown to the valves that carry the JOHNSON Trade Mark.

The prices as well as the valves are right.



Air Regulating Valve

Johnson Service Co.

MILWAUKEE, WIS.

Branches Everywhere

Steam Reducing Valve

the company's thermostat department, with headquarters in Philadelphia, at 1211 Filbert St.

SAFFORD RADIATOR CORPORATION, Detroit, Mich., which was recently incorporated at Dover, Del., with a capital stock of $10,000,000, will manufacture sheet metal radiators, in addition to a line of boilers and furnaces. The incorporators are Clarence E. Safford, Frank J. Singer and Jere T. Purdy, all of Detroit.

New Firms and Business Changes.

KRUEGER PLUMBING & HEATING Co., Butte, Mont., announces that I. Krueger, the head of the company, has disposed of his interest to Charles P. Nevin and William J. Magill, both of Butte. The business was started by Mr. Krueger in 1889, and has become one of the best-known contracting firms in this line in the Northwest.

CRONIN, BAKER & TINDALL, Memphis, Tenn., is the new title of J. A. Bailey & Co., Inc., contractors for heating, plumbing and lighting.

F. O. MISNER PLUMBING & HEATING Co., Dodge City, Kan., has succeeded to the business of Misner & Groody.

CLIMAX LOCK & VENTILATOR Co., Buffalo, N. Y., has increased its capital stock from $150,000 to $250,000.

SECOR PLUMBING Co., Forest City, Ia., has been established by Morris Secor to conduct a heating and plumbing business.

BECKER-SEIDEL Co., Cleveland, O., has moved to new quarters at 324 Prospect Ave., N. W., where the company occupies a two-story building, 60x100 ft.

New Incorporations.

SANITARY PLUMBING AND HEATING Co., Erie, Pa., capital, $5,000. Incorporators: G. Y. Hollister, John Sneiderwein, N. M. Hollister and H. Sneiderwein.

LOCOMOTIVE SUPERHEATER Co., Wilmington, Del., capital $2,500,000. Among those prominently interested is F. F. McWhiney.

ADAIR LIGHT & HEATING Co., Adairville, Ky., capital $5,000. Incorporators: M. E. Orndorff, B. M. Pulliam, G. A. Smith and J. B. Fisher.

FRANK T. YOUNG Co., Bar Harbor, Me., capital $7,500, to conduct heating and plumbing business. President, Frank T. Young; treasurer, John P. Carney.

ADVANCE HEATING Co., Chicago, Ill., capital $2,500, to engage in building and construction of steam and hot water plants, etc. Incorporators: Marcus Weil, Otto W. Jurgens and Cecil C. Erickson.

CONSOLIDATED PLUMBING & HEATING Co., West New York, N. J., capital $15,000, to engage in heating, plumbing, gas fitting, etc. Incorporators: A. Hurwitz, H. A. Rosen and H. Gorman.

MODERN PLUMBING & HEATING Co., Camden, N. J., capital $25,000, to conduct heating and plumbing business. Incorporators: William D. Griffith, Harriett T. Griffith, William T. Reed and Effie M. Reed.

COLUMBUS HEATING Co., Indianapolis, Ind., capital $15,000. Incorporators: Henry H. Buckman, Jr., Ored H. Ragsdale and Louis E. Lathrop.

CARTER WATER HEATING MFG. Co., Providence, R. I., capital $200,000, to manufacture water heating devices, including radiators. Incorporators: Isidor L. Halman, Howard A. Cram and Robert G. Mowry.

DEHLER BROS. Co., Louisville, Ky., capital $50,000, to deal in heating and plumbing supplies.

FRANK W. HUGHSON Co., Elmira, N. Y., capital $15,000, to conduct a heating and plumbing business. Incorporators: F. W. Hughson, Cora L. Hughson and Cora H. Hughson.

SHEBOYGAN PLUMBING Co., Sheboygan, Wis., capital $5,000. Incorporators: J. J. Ramadker, Gotlieb Merz and Frank Guenther.

BLASIER-SANBORN MFG. Co., Utica, N. Y., capital $350,000, to manufacture steam specialties. Incorporators: Frederick A. Klein, George W. Sanborn and C. Sanborn, all of Utica.

THERON-POND Co., Milford, Conn., capital $4,000, to conduct a heating and plumbing business.

RECTOR SYSTEM GAS HEATING Co., San Francisco, Cal., capital $500,000, to manufacture the Rector gas heating system. Incorporators: M. E. Wooster, A. R. Wooster, W. G. Banning, M. J. Dewey and A. D. Moore.

DECARIE SAFETY BOILER Co., Portland, Ore., to manufacture steam heating boilers. President, Roderick Maclay; vice-president and general manager, F. L. Decarie. The company has taken a plant near 19th St., Portland.

ALLEGHENY COUNTY STEAM HEATING Co., Pittsburgh, Pa., capital $5,000.

PULSER MFG. Co., Montgomery, Ala., capital $50,000, to manufacture heating specialties. President, R. Hagger; vice-president, D. R. Dreyfus; secretary and general manager, C. F. Gallinger; treasurer, J. A. Young.

JOHN H. FITZGERALD Co., Boston, Mass., capital $10,000, to conduct a heating and plumbing business. Incorporators: Thomas E. Fitzgerald and Grace B. Ducett.

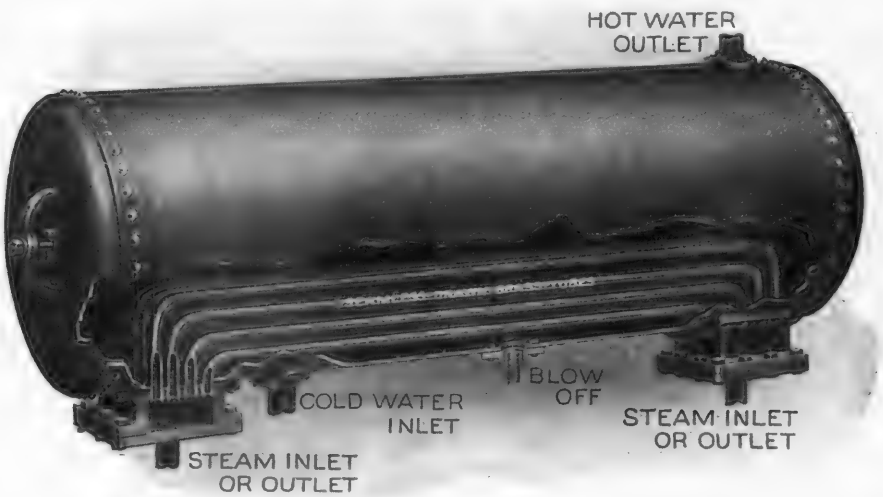
ANDREW G. PAUL Co., Boston, Mass., capital $300,000, to manufacture vacuum heating specialties. Incorporators: Van Courtlandt Lawrence, Henry W. Sprague and D. E. Mannings.

CENTRAL HEATING Co., Erie, Pa., capital

PATTERSON
HOT WATER TANK

the practical improvement upon the old style tank and coil.

Boiler Plate Shells, Heavy Seamless Drawn Brass Tubes. For use with exhaust or live steam, or low pressure boilers.



There is no idle heating surface in Patterson Plumbers' Tank Heaters. The steam enters the large expansion chamber, expands and uniformly fills the large number of "∩" shaped tubes of small diameter the area of which is much greater than of the steam inlet pipe. As fast as the steam condenses in transmitting its heat to the surrounding water, this condensation is discharged to the condensation chamber and flows by gravity back to the boiler.

In the ordinary tank where a coil or return bend is used of the sam area or size as the steam inlet pipe, its heating efficiency is rapidly destroyed, due to its being filled up by the water of condensation which forms more rapidly than it can be discharged through the single pipe.

Patterson Heaters never create back pressure. The tubes never leak. The heads never blow out.

FRANK PATTERSON & CO.

26 CORTLANDT STREET
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$50,000. Directors: Thomas G. O'Dea, Stephen G. Walker and Charles H. Strong, all of Erie.

Business Troubles.

RICHMOND SALES Co., New York, selling agents for McCrum-Howell Co., New York, has filed a petition in bankruptcy. The liabilities of the sales company are $677,287, of which $441,558 is due the McCrum-Howell Co., and $16,120 to L. G. McCrum and G. D. Howell. The assets amount to $72,370. The sales company operated 40 agencies in various parts of the country for the sale of Richmond heaters and vacuum cleaning apparatus.

Contracts Awarded.

TALCOTT & MOORE, Washington, D. C., heating and ventilating Virginia Theater at that place.

W. H. BURKE & Co., South Bend, Ind., heating and plumbing the St. Joe building at South Bend. A Webster modulation system will be installed.

JOHN O'NEILL & SONS, Peoria, Ill., heating and plumbing the Proctor Field house, at Peoria, which is to be a combined gymnasium, public bath house and library. The contract for the heating and plumbing amounts to $25,000. The building is being constructed by the trustees of the John C. Proctor endowment fund.

DE MOLLETT & CORNWALL, Athens, O., extension of the steam heating plant at the Ohio State University at Athens. F. L. Packard, Columbus, architect.

PHOENIX HEATING Co., Grand Rapids, Mich., heating Smith Memorial Church at Grand Rapids from plans drawn by Wernette & Bradfield, of that place. Wernette & Bradfield have also drawn the plans for the heating of the Lessees Western Theological Seminary at Holland, Mich.

MINOT HEATING & PLUMBING Co., Minot, N. D., heating, ventilating and plumbing the State Normal School at Valley City, for $30,000. The contract for the electrical work went to Olson & Harris, St. Paul.

ATCHISON, KAN.—The following bids were submitted for the heating and ventilation of the Washington High School at Atchison, Sayler & Sedden, architects:

		Steam Furnace
Cunningham Heating & Plumbing Co., Kansas City, Mo.	$5,900	$5,750
A. McKinley Co., Kansas City, Mo.	6,500	5,250
Mueller Heating Co., Kansas City, Mo.	6,685	5,166
Lewis & Kitchen, Kansas City, Mo.	6,175	5,235

GEORGE JACKSON, Portland, Ore., heating plant for the Hawthorne School and the gymnasium of the Washington High School, at Portland, to cost $3,000.

A. W. FOLLETTE, Geneva, O., heating armory building at Jefferson. The work is to be finished by December 24, with a forfeit for each day's delay beyond that time.

WOOLEN & CALON, Indianapolis, Ind., heating and plumbing the Prest-O-Lite factoryr for $19,000; also steam mains and high pressure connections for plant of the Citizens' Gas Co., Indianapolis.

HAYES BROS., Indianapolis, Ind., steam heating new colored Y. M. C. A. building for $15,000; also low bidder for the heating and plumbing of the Severin Hotel, at that place.

GENERAL ENGINEERING Co., San Francisco, Cal., steam heating Jean Allec Building at Ellis and Larkin Sts., for $2,275.

PACIFIC BLOWER & HEATING Co., San Francisco, Cal., was the low bidder for the heating and ventilation of the new $160,000 high school building at Lodi. The company's bid was $6,785.

HANLEY-CASEY Co., Chicago, Ill., heating Railway Exchange Building at Olive and Locust Sts., St. Louis, Mo. The building is 22 stories in height.

C. B. SANBORN & Co., heating and ventilating new high school building at Wellesley, Mass., for $15,390.

ALLEN & READ, Providence, R. I., heating Industrial School at Sockanossett.

D. F. FARRELL & Co., Pittsfield, Mass., steam heating and plumbing new block on Bradford St., Pittsfield.

REGAN & HORNWELL, Monongahela City, Pa., heating and plumbing new school at Cokeburg for $10,000.

BAKER, SMITH & Co., Pittsburgh, Pa., heating $40,000 garage at Pittsburgh, for the O'Hara Estate.

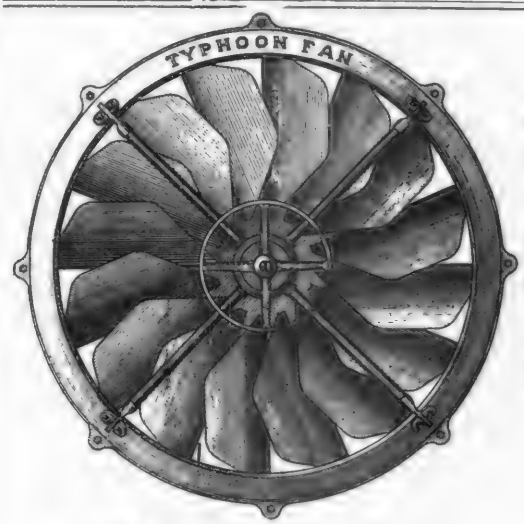
FITZPATRICK & HOEPFNER, Columbus, O., steam heating and plumbing new city hospital in Louisville, Ky. The hospital consists of eleven buildings and will cost, when complete, $1,000,000. The steam heating and plumbing contracts are among the largest that have ever been let in Louisville.

URBAUER-ATWOOD HEATING Co., Cleveland, O., heating six-story office building at Olive and Vandeventer Aves., in that city.

ROBERT DALZIEL, JR., San Francisco, Cal., heating, ventilating and plumbing contracts for the Kahn department store building at Oakland. The work will amount to $50,000.

HENNESSEY BROS., Oswego, N. Y., heating and plumbing new terminal station for the Syracuse, Lake Shore & Northern Railroad Co., at Syracuse.

TYPHOON FANS



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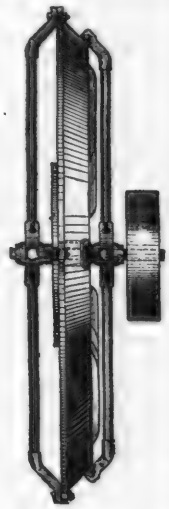

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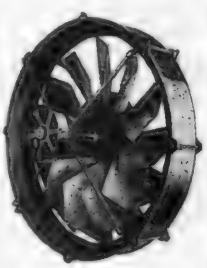
The **TYPHOON FAN** is particularly adapted to such unit systems and is built with a number of blades of a width and pitch to meet any special requirement.

SPECIAL PRICE LIST

Diameter of Fan	Revolutions per Minute	Capacity per minute in Cubic Feet	PRICE	
			Standard	Standard Brick Set
30 in.	325-650	4570- 9139	$32.50	$40.00
36 "	275-550	6683-13365	40.00	50.00
42 "	235-470	9070-18137	50.00	60.00
48 "	200-400	11520-23040	60.00	75.00
54 "	175-350	14352-28704	75.00	92.50
60 "	165-330	18562-37125	92.50	110.00
72 "	135-270	26244-52488	125.00	150.00



Brick Set Type

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PENINSULA HEATING AND PLUMBING Co., Laurium, Mich., heating and vacuum cleaning new high school building at Chrystal Falls, Mich., for $12,000 for the heating and $826 for the vacuum cleaning plant; the plumbing contract went to John Obermeyer, Iron Mountain, Mich., at his bid of $5,732.

A. C. SCHIRMER Co., Hibbing, Minn., heating and ventilating new high school building at Buhl, Minn.

THOMAS HEATING Co., Racine, Wis., heating factory buildings of the International Harvester Co., at Springfield, O., for $15,000.

J. P. DWYER & Co., Boston, Mass., heating and ventilating new Children's Hospital building in Boston, for $5,068. Other bids were: Albert B. Franklin, $6,500; Ingalls & Kendricken, $6,685; J. J. Hurley & Co., $5,775; Pierce & Cox, $5,237; Power Heating and Ventilating Co., $5,249. The plumbing contract went to Edward C. Kelley, at his bid of $5,717.

G. E. HASLAM, North Providence, R. I., heating and ventilating new Greystone School at that place.

W. J. SCHOOL Co., Youngstown, O., heating Youngstown City Hospital for $14,000; also heating and plumbing Thiel College at Greenville, O.

IRON CITY HEATING Co., Pittsburgh, Pa., heating new $70,000 residence for H. H. McLaughlin.

RELIANCE HEATING Co., Pittsburgh, Pa., heating Pennsylvania Railroad station at Tarentum, Pa.

A. B. FELS, Portland, Me., heating and ventilating new police station at Portland, for $4,064 and an additional bid of $435 for a vacuum cleaning system. Other bids were: Wiley & Calhoun, $4,800 and $400; and A. H. Moulton, $4,365 and $435. The plumbing contract went to A. L. Dow & Co., at their bid of $4,446.

F. S. SCHARDEIN & SON, Louisville, Ky., heating and plumbing Masonic Widows' and Orphans' Home, at Louisville, for $10,000.

Business Chances.

WASHINGTON, D. C.—Proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until Dec. 17, 1912, for the construction, including plumbing, gas piping, heating apparatus, etc., of the United States Post Office at Lorain, O. One story, with basement and mezzanine; ground area, 8,400 sq. ft.

Until Dec. 26, 1912, for the construction, including plumbing, gas piping, heating apparatus, etc., of the United States Post Office at Clarksville, Texas.

Until Jan. 6, 1913, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, vacuum cleaning system, and lift of the United States Sub-Treasury building at San Francisco, Cal. Two stories and basement; ground area, 10,000 sq. ft. Drawings and specifications may be obtained from J. Milton Dyer, 825 Cuyahoga Building, Cleveland, O., and from J. W. Roberts, supervising superintendent of construction, 403 Post Office and Courthouse Building, San Francisco, Cal., as well as from the Supervising Architect.

Until January 7, 1913, for the construction complete, including plumbing, gas piping, heating apparatus, etc., of the U. S. Post Office at Abilene, Kan. One-story and basement. Ground area, 5,000 sq. ft.

Until January 8, 1913, for the construction complete, including plumbing, gas piping, heating apparatus, etc., of the annex to the U. S. Post Office at Paris, Tex. Two stories and basement. Ground area, 7,000 sq. ft.

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WANTED, a young man in the office of a heating concern. One who has had experience preferred. Good opportunity for advancement. State qualifications and salary desired. Address Heating, care of HEATING AND VENTILATING MAGAZINE.

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Same—36" Fan, 1½ H. P., No. 6747, 110 volts, 12 Amp., Speed 360, Type T. B.

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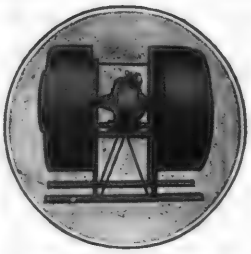

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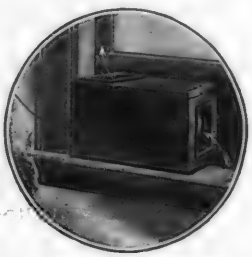

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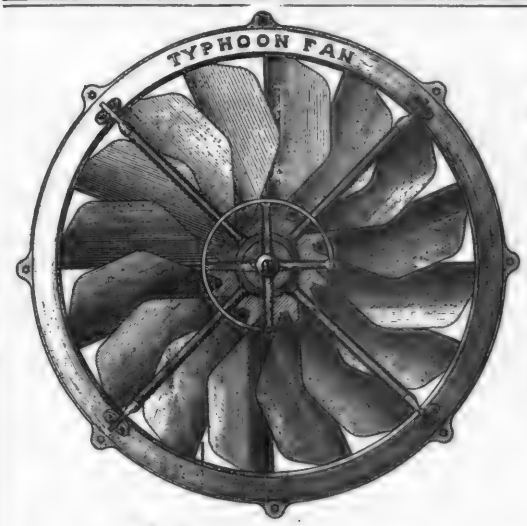

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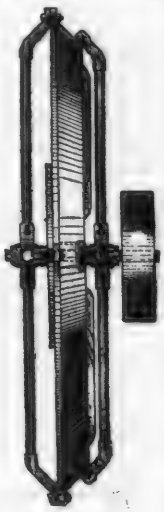

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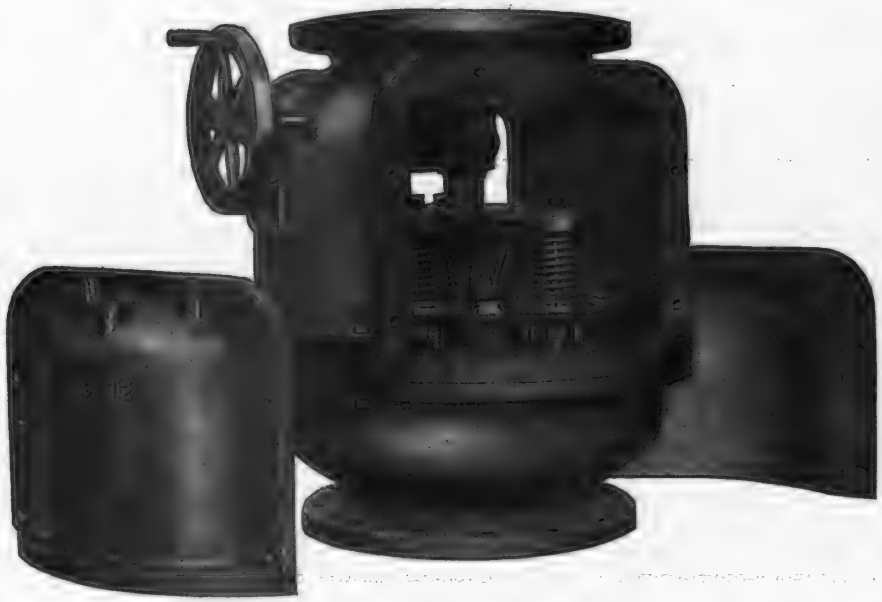

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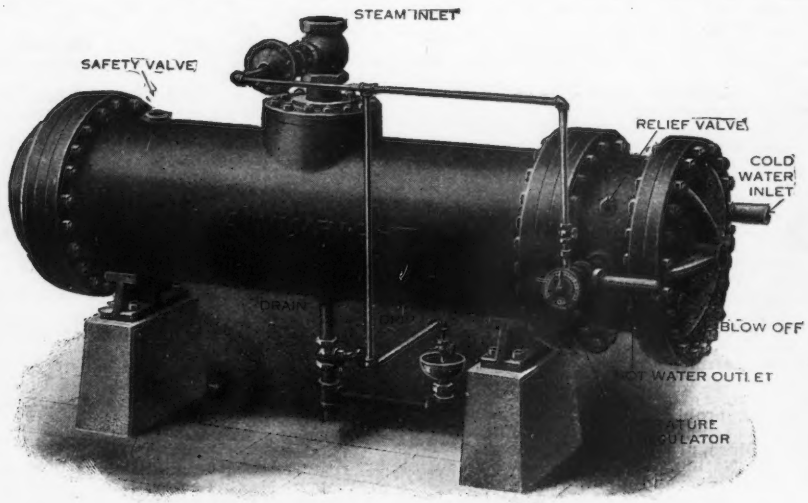

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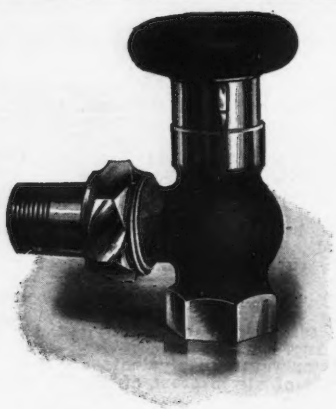

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